

U.S. UNIX MARKET, 1991-1996

INPUT

About INPUT

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions.

Continuous-information advisory services, proprietary research/consulting, merger/acquisition assistance, and multiclient studies are provided to users and vendors of information systems and services (software, processing services, turnkey systems, systems integration, professional services, communications, systems/software maintenance and support).

Many of INPUT's professional staff members have more than 20 years' experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning. This expertise enables INPUT to supply practical solutions to complex business problems.

Formed as a privately held corporation in 1974, INPUT has become a leading international research and consulting firm. Clients include more than 100 of the world's largest and most technically advanced companies.

INPUT OFFICES

North America

San Francisco

1280 Villa Street
Mountain View, CA 94041-1194
Tel. (415) 961-3300
Fax (415) 961-3966

New York

Atrium at Glenpointe
400 Frank W. Burr Boulevard
Teaneck, NJ 07666
Tel. (201) 801-0050
Fax (201) 801-0441

Washington, D.C.

1953 Gallows Road, Suite 560
Vienna, VA 22182
Tel. (703) 847-6870
Fax (703) 847-6872

International

London

Piccadilly House
33/37 Regent Street
London SW1Y 4NF, England
Tel. (071) 493-9335 Fax (071) 629-0179

Paris

52, boulevard de Sébastopol
75003 Paris, France
Tel. (33-1) 42 77 42 77 Fax (33-1) 42 77 85 82

Frankfurt

Sudetenstrasse 9
D-6306 Langgöns-Niederkleen, Germany
Tel. (0) 6447-7229 Fax (0) 6447-7327

Tokyo

Saida Building
4-6, Kanda Sakuma-cho
Chiyoda-ku, Tokyo 101, Japan
Tel. (03) 3864-0531 Fax (03) 3864-4114

000020

A P R I L 1 9 9 1

U.S. UNIX Market 1991-1996

INPUT LIBRARY

INPUT®

Published by
INPUT
1280 Villa Street
Mountain View, CA 94041-1194
U.S.A.

Information Systems Market Program (ISP)

U.S. UNIX Market, 1991-1996

Copyright ©1991 by INPUT. All rights reserved.
Printed in the United States of America.
No part of this publication may be reproduced or
distributed in any form or by any means, or stored
in a data base or retrieval system, without the prior
written permission of the publisher.

Abstract

This report provides analyses and five-year forecasts of the U.S. UNIX systems software products market for the period 1991-1996. Factors driving the market, from the vendor and user perspective, are discussed and provide a framework for the forecasts. Forecasts are presented for each systems software product category—systems control, applications development tools, and operations management products. Unix operating system forecasts are presented by hardware platform size.

Unix is impacting all vendors in all systems software product categories, as well as vendors in other IS delivery modes. UNIX also will have a major impact on buying behavior as users shift from making purchase decisions based on hardware to decisions that emphasize software products and services. The report discusses these impacts as well as the status of standards, recent technology developments, and the UNIX strategies of leading systems and software vendors.

The report contains 82 pages and 44 exhibits.

U.S. UNIX MARKET
1991-1996

U1153
1991-1996
COPY 1

AUTHOR

TITLE

DATE
LOANED

BORROWER'S NAME

~~5-24~~ Paul K



Table of Contents

I	Introduction	I-1
	A. Objectives	I-1
	B. Scope and Methodology	I-2
	1. Scope	I-2
	2. Methodology	I-4
	C. Report Structure	I-5
	D. Related INPUT Reports	I-6
II	Executive Overview	II-1
	A. UNIX Environment	II-1
	B. User Requirements, Issues, Trends	II-3
	C. Competitive Analysis	II-4
	D. Market Forecast	II-5
	E. Conclusions	II-7
III	UNIX Background	III-1
	A. Business Issues and Trends Impacting UNIX	III-1
	B. UNIX	III-3
	C. Standards	III-5
	1. Standards Status	III-5
	2. Standards Bodies	III-7
	3. User Groups	III-10
IV	The User View	IV-1
	A. Current Users	IV-3
	1. Reasons for Implementing UNIX	IV-4
	2. Level of Success with UNIX	IV-7
	3. In-house versus External Resources	IV-8
	B. Non-UNIX Users	IV-9
	1. Reasons UNIX Was Not Selected	IV-9

Table of Contents (Continued)

IV	2. Barriers to Implementing UNIX	IV-11
	C. Summary	IV-14
V	The Vendor View	V-1
	A. Industry Structure	V-1
	B. Level of Vendor Involvement	V-2
	1. Systems Vendors	V-2
	a. Digital Equipment Corp.	V-6
	b. Hewlett-Packard	V-7
	c. IBM	V-7
	d. NCR	V-9
	e. Unisys	V-9
	2. Systems Management and Application Development Tool Vendors	V-10
	3. Applications Software Products Vendors	V-14
	a. Computer Associates	V-16
	b. The Santa Cruz Operation (SCO)	V-17
	c. Other UNIX Applications Software Products Vendors	V-17
	4. Niche Players	V-18
	C. Support and Distribution	V-19
	1. Professional Services and Systems Integrators	V-19
	2. Distribution	V-20
	D. Conclusions about Vendors	V-20
VI	Market Forecast	VI-1
	A. Systems Software Forecast	VI-3
	1. Systems Software Expenditures by Product Category	VI-3
	2. UNIX's Share of Systems Software Expenditures	VI-5
	3. UNIX User Expenditure Forecast	VI-6
	B. UNIX Operating System Forecast	VI-7
	C. Driving Forces	VI-9
	1. UNIX Advantages	VI-9
	2. Level of Vendor Endorsement and Product Availability	VI-9
	3. User Interest in, and Demand for, UNIX	VI-11
	D. European UNIX Marketplace	VI-11
	E. Impact of UNIX on Other Information Services Delivery Modes	VI-13
	1. Processing Services	VI-14
	2. Turnkey Systems Vendors/VARs	VI-14

Table of Contents (Continued)

VI	3. Applications Software Products	VI-14
	4. Systems Integration	VI-15
	5. Professional Services	VI-15
	6. Systems Operations	VI-15

VII	Conclusions and Recommendations	VII-1
	A. Conclusions	VII-1
	B. Recommendations	VII-2

Exhibits

I	<ul style="list-style-type: none"> -1 Information Services Industry Structure—1991 -2 Systems Software Market Structure—1991 	<ul style="list-style-type: none"> I-3 I-4
II	<ul style="list-style-type: none"> -1 Business Issues and Technology Trends Impacting UNIX -2 Percent of Respondents Using or Planning to Use UNIX -3 Vendor Activity and User Adoption -4 UNIX Share of Systems Software Products by Major Product Category, 1991 and 1996 -5 UNIX Systems Software Market User Expenditures by Major Product Category, 1991 and 1996 	<ul style="list-style-type: none"> II-1 II-3 II-4 II-5 II-6
III	<ul style="list-style-type: none"> -1 Business Issues and Technology Trends Impacting UNIX -2 Standards Progress -3 Areas Where Standards Progress Needed -4 Profile: UNIX International -5 Profile: Open Software Foundation -6 Profile: X/Open Company, Ltd. -7 Profile: User Alliance for Open Systems (UAOS) 	<ul style="list-style-type: none"> III-1 III-6 III-6 III-7 III-8 III-9 III-11
IV	<ul style="list-style-type: none"> -1 Percent of Respondents Using or Planning to Use UNIX -2 UNIX Users and Their Applications -3 UNIX Users' Reasons for Seeking Another Solution -4 UNIX Users' Reasons for Selecting UNIX -5 UNIX Users' Level of Success with UNIX -6 UNIX Users' Successes and Complaints -7 Non-UNIX Users' Reasons for Not Considering UNIX -8 Non-UNIX Users' Barriers to Implementing UNIX -9 Non-UNIX Users' Advantages of Current Operating System over UNIX 	<ul style="list-style-type: none"> IV-2 IV-3 IV-4 IV-5 IV-7 IV-8 IV-10 IV-12 IV-12
V	<ul style="list-style-type: none"> -1 UNIX Market Evolution—Timing of Product Availability -2 Systems Vendors' Strategic UNIX Challenges -3 Selected Hardware Vendors' UNIX Directions -4 UNIX System Management and Development Tools— Product Issues/Market Needs 	<ul style="list-style-type: none"> V-3 V-3 V-5 V-11

Exhibits (Continued)

V

-5	Systems Software Vendors' UNIX Activities	V-12
-6	Applications Software Products Vendors' UNIX Opportunities/Challenges	V-15
-7	Applications Software Products Vendors' UNIX Posture	V-16
-8	UNIX Distribution Channel Challenges	V-20
-9	Vendor Activity and User Adoption	V-21

VI

-1	UNIX Market Acceptance Process	VI-2
-2	Vendor Involvement and UNIX Product/Service Availability	VI-3
-3	Systems Software Market by Major Product Category	VI-4
-4	UNIX Share of Systems Software Products Market by Major Product Category, 1991 and 1996	VI-6
-5	UNIX Systems Software Market User Expenditures by Major Product Category, 1991 and 1996	VI-7
-6	UNIX Operating Systems User Expenditure Forecast by Platform Size	VI-8
-7	UNIX Market Drivers	VI-10
-8	Western European UNIX Systems Software Market—User Expenditures by Major Product Category, 1991 and 1996	VI-12
-9	Impact of UNIX on Other IS Delivery Modes	VI-13

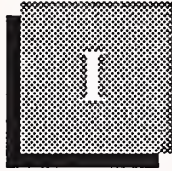
VII

-1	U.S. UNIX Market Conclusions	VII-1
-2	U.S. UNIX User Recommendations	VII-3
-3	U.S. UNIX Vendor Recommendations	VII-3



Introduction





Introduction

UNIX is becoming an important and controversial operating system as equipment vendors move away from their own proprietary operating systems and architectures towards open systems. During the 1980s the PC operating system MS-DOS showed suppliers and users alike how the widespread adoption of an industry standard can have a dramatic effect on the market. Lower prices and much broader product choice are two of the most obvious results of open competition in the market. As users begin to switch their allegiances from equipment brands to software, many vendors are experiencing changes in their competitive market positions.

A

Objectives

The purpose of this report is to assess the degree to which the UNIX operating system will be deployed over the next five years. The focus is the U.S. market for UNIX operating systems. The report identifies key driving forces in the UNIX marketplace and a user expenditures forecast is developed for UNIX systems software, with a focus on UNIX operating systems.

In particular the report addresses:

- Status of standards relating to UNIX
- Reasons UNIX is being deployed and level of success
- End-user concerns about UNIX and why it is not being deployed
- Impacts of UNIX on information services delivery modes
- UNIX Vendors and their level of involvement and UNIX strategies
- Technology progress status report

B

**Scope and
Methodology****1. Scope**

The primary focus of this report is the market and vendor dynamics impacting user expenditures for UNIX operating systems. User expenditures forecasts are presented for systems software and its subcategories, UNIX's portion of systems software and its subcategories, and UNIX operating systems for 1991-1996.

Secondly, this report addresses the impacts of UNIX on the other information services delivery modes, and the impacts of those modes on user expenditures for UNIX. The delivery modes with the most relevance to UNIX are the other two systems software submodes—operations management and applications development tools—and applications software products.

Exhibit I-1 defines the structure of the information services industry as used by INPUT in its market analyses and forecasts. The market consists of eight delivery modes, each of which contains a number of submodes.

Exhibit I-2 shows the three main product types within the systems software delivery mode.

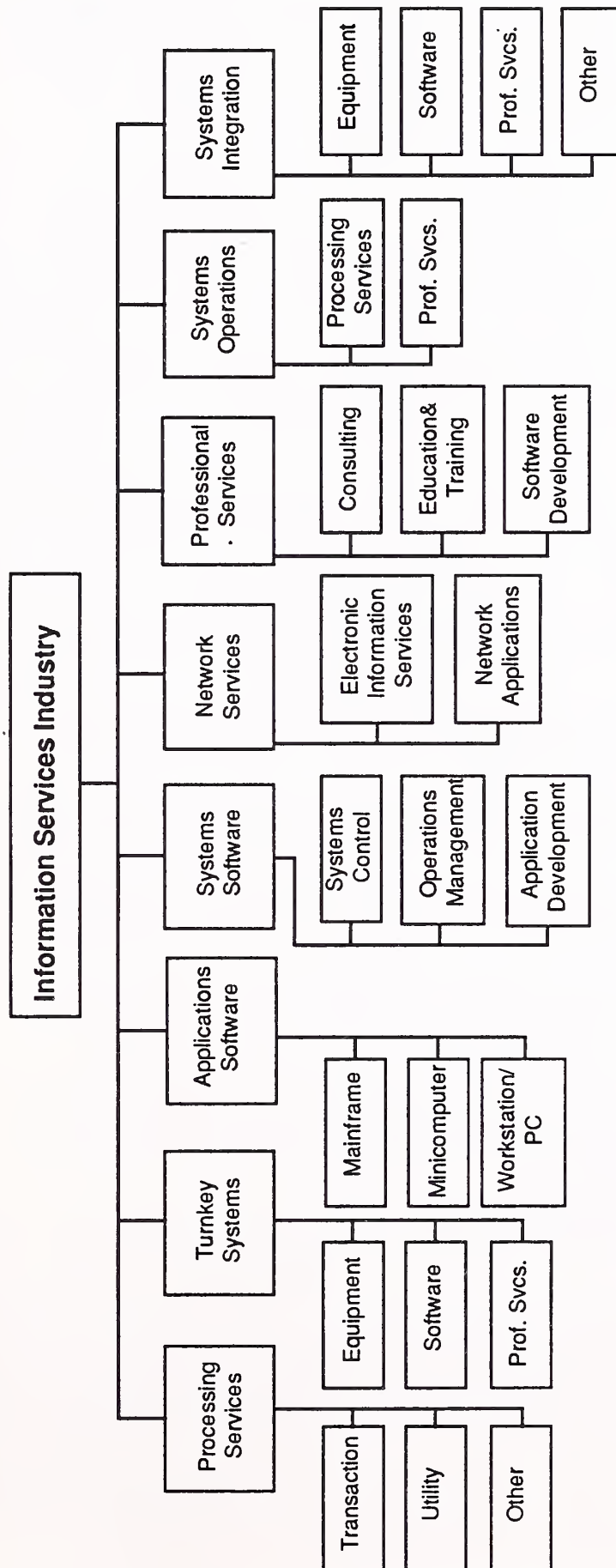
The three systems software submodes are defined as follows:

- **Systems Control Products** - Software programs that function during application program execution to manage computer system resources and control the execution of the application program. These products include operating systems, emulators, network control, library control, windowing, access control, and spoolers.
- **Operations Management Tools** - Software programs used by operations personnel to manage the computer system and/or network resources and personnel more effectively. Included are performance measurement, job accounting, computer operation scheduling, disk management utilities, and capacity management.
- **Applications Development Tools** - Software programs used to prepare applications for execution by assisting in designing, programming, testing, and related functions. Included are traditional programming languages, 4GLs, data dictionaries, data base systems, and other development productivity aids. Also included are systems utilities (e.g., sorts) that are directly invoked by an applications program.

Systems software involves user purchases of software packages for in-house computer systems. Included are lease and purchase expenditures, as well as expenditures for work performed by the vendor to implement or maintain the package at the user's site. Vendor-provided training or support for operating and using the package, if bundled in the software pricing, is also included here.

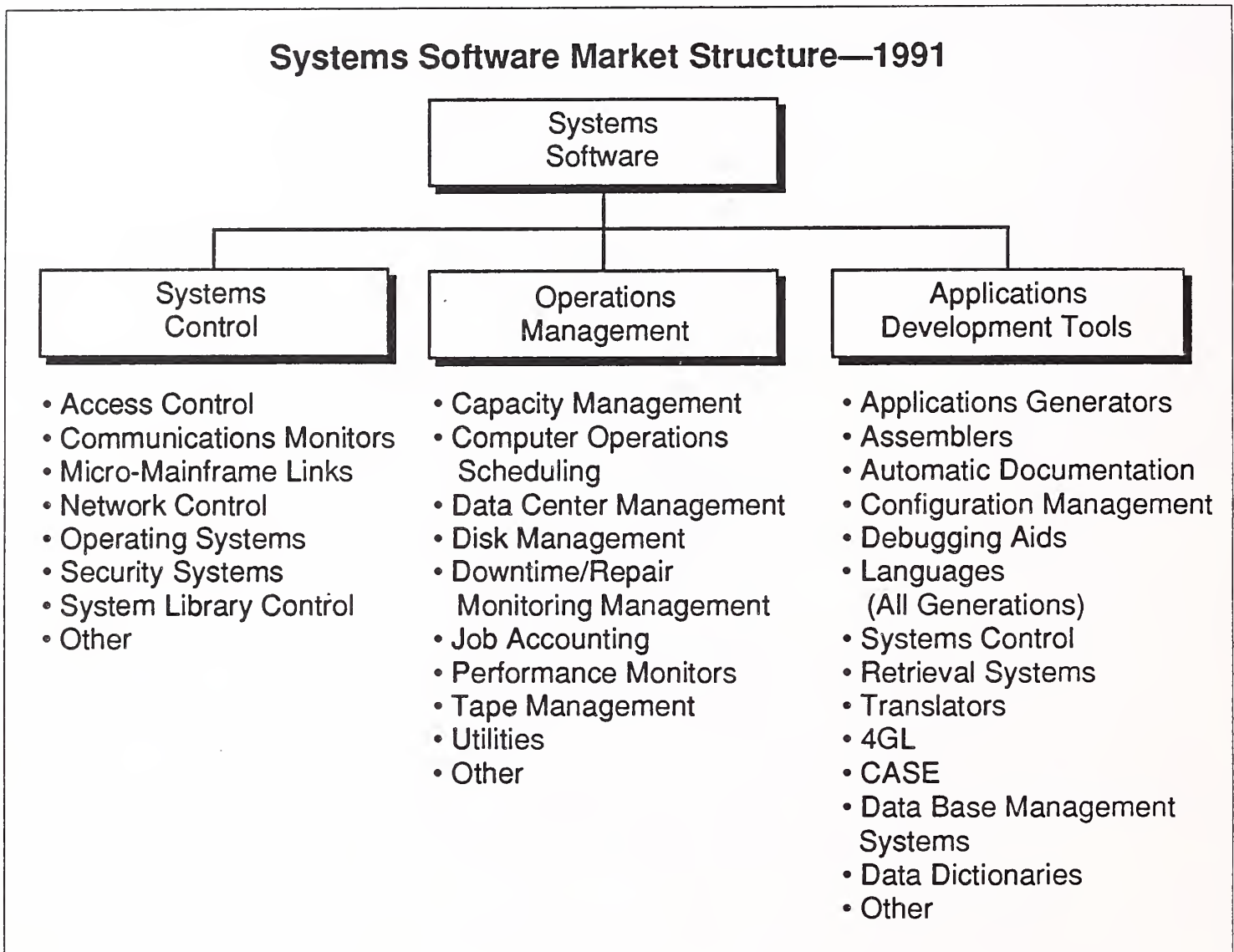
EXHIBIT I-1

Information Services Industry Structure—1991



Source: INPUT

EXHIBIT I-2

Systems Software Market Structure—1991**2. Methodology**

The report draws on in-depth telephone interviews with end-user organizations as well as interviews with vendors that are or will be key UNIX participants.

The surveys were:

- Twenty-six telephone interviews were conducted with the IS management of end-user organizations that represent a cross-section of vertical industries and company sizes. The companies ranged from those with little if any knowledge about UNIX and did not have plans to implement UNIX, to those with a large UNIX implementation and for which UNIX was key to overall IS strategies. The interviews were in depth, often lasting 30 minutes or so. They explored issues and questions of a qualitative nature.

- In-depth telephone interviews were conducted with ten systems, software, and services vendors. Included were large-systems vendors, applications software companies who already possess or have plans for UNIX product lines, several large-systems integrators and professional services firms, systems control products and applications development tool companies, and several niche UNIX players.

Attendance at Uniforum and an ongoing library data-gathering-and-analysis effort was also part of the research for this report. INPUT consultants who monitor trends and issues in information systems and services—senior consultants that follow all delivery modes in U.S. offices and European offices—collaborated in this effort.

In addition, this report utilizes information from several previous INPUT reports, in particular those listed in Section D of this chapter.

The user expenditures forecast for the UNIX operating system derived from information obtained from the surveys and secondary research described above, as well as previous knowledge about systems software and user expenditures on products within systems software obtained through research conducted for INPUT's report *U.S. Systems Software Markets, 1990-1995* during the latter part of 1990.

C

Report Structure

U.S. UNIX Market, 1991-1996 is organized as follows:

- Chapter II is an Executive Overview providing a summary of the research findings, analysis, and conclusions and recommendations.
- Chapter III—UNIX Background—presents business and technology trends impacting UNIX and the status of standards related to UNIX.
- Chapter IV—The User View—reports the findings and analyzes the results of the user survey, thereby providing the demand-side forces impacting user expenditures on UNIX.
- Chapter V—The Vendor View—presents strategies and the positioning of key hardware vendors, systems management and applications development tool vendors, and applications software products vendors. The status and issues concerning a UNIX support and distribution infrastructure are discussed.
- Chapter VI—Market Forecast—The driving forces impacting UNIX user expenditures are identified and discussed, an overall forecast is presented, and forecasts by platform size are projected—for mainframes, minicomputers, and workstations/PCs.
- Chapter VII—Conclusions and Recommendations—gives INPUT's conclusions and recommendations for UNIX users and vendors.

D

Related INPUT
Reports

Recent INPUT reports of direct relevance to this study include:

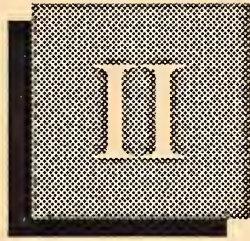
- *U.S. Systems Software Products 1990-1995*
- *Western European Market for Systems Software, Forecast and Analysis, 1990-1995*
- *Western Europe UNIX Market Opportunities, 1990-1995*
- *Managing Information Technology in the 1990s*

Other related reports of interest are:

- *U.S. Market for UNIX, 1989-1994*
- *U.S. Applications Solutions Market, 1990-1995*
- *U.S. Processing Services Market, 1990-1995*
- *U.S. Professional Services Market, 1990-1995*
- *U.S. Systems Integration Market, 1990-1995*
- *U.S. Systems Operations Market, 1990-1995*
- *U.S. Processing Services Market, 1990-1995*
- *Vendor Analysis Program*

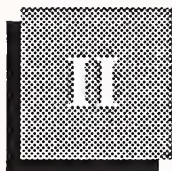
U.S.—Over 300 profiles of prominent U.S. software and services vendors. Includes regular updates and new profiles.

Europe—Over 300 profiles of prominent software and services vendors across Europe; includes regular updates and new profiles.



Executive Overview





Executive Overview

The attraction of UNIX, and the broader area of open systems, is lower costs and improved efficiencies for users and vendors. Users need to learn how to take advantage of what UNIX has to offer and vendors will have to compete on the basis of product availability, new pricing structures, and strong systems integration and professional services.

A

UNIX Environment

Several technology forces are converging to create an environment receptive to UNIX products. Some of these forces are listed in Exhibit II-1.

EXHIBIT II-1

Business Issues and Technology Trends Impacting UNIX

- Inefficient islands of technology persist
- Complexity of software development increasing
- Desktop price/performance advantages soar
- Systems vendors' profits at all-time low
- Applications software products vendors seek new opportunities

U.S. corporations are continuing to experience slow productivity improvements. A recent report published by the Bureau of Labor Statistics reflects a growing opinion among economists that the long-term problem in the nation's economy is not factory inefficiency but productivity growth among sectors employing predominantly white-collar workers. White-collar productivity has averaged gains of less than 1% per year during the 1980s.

As a result, users are unwilling to begin using new technology unless it obviously boosts productivity and is integratable with what they already have. Given that many users currently have proprietary applications solutions running on proprietary hardware, interoperability is key to UNIX's long-term success.

UNIX has the potential to increase efficiency through portability, scalability, and interoperability, thereby connecting islands of technology. The productivity improvements and efficiency gains brought about by interoperability are obvious: it protects buyers' investments in hardware, software, and training, and enhances the accuracy of information distributed, shared, and modified by a number of different people.

Lower cost is the primary driving force behind the trend of organizations to decentralize their businesses and downsize their computer operations. The cost of raw computing power on the desktop has dropped much faster than the cost of boosting computing power on large systems.

Systems software vendors also stand to gain by climbing on the UNIX bandwagon. A key challenge is how to fully embrace standards while at the same time maintain some differentiating characteristics. Another critical decision facing both systems and applications software products vendors is which UNIX standards to embrace.

Although the original UNIX has been around since it was created in 1969 by AT&T, it has only recently received attention for commercial or production-level applications. Product attributes that were not necessary in typically small technical and engineering configurations—such as system administration, performance monitoring, and high security levels—need to be built up for the commercial marketplace.

Interoperability becomes more important in the commercial marketplace. Standards are necessary for true interoperability. The marketplace seems content with several UNIX operating system kernels as standards—OSF/1, and AT&T's UNIX System V.4 are the two primary standard kernels. But progress is still needed in many technical areas, including networking technologies, windowing software, CASE tools, and integrated data bases.

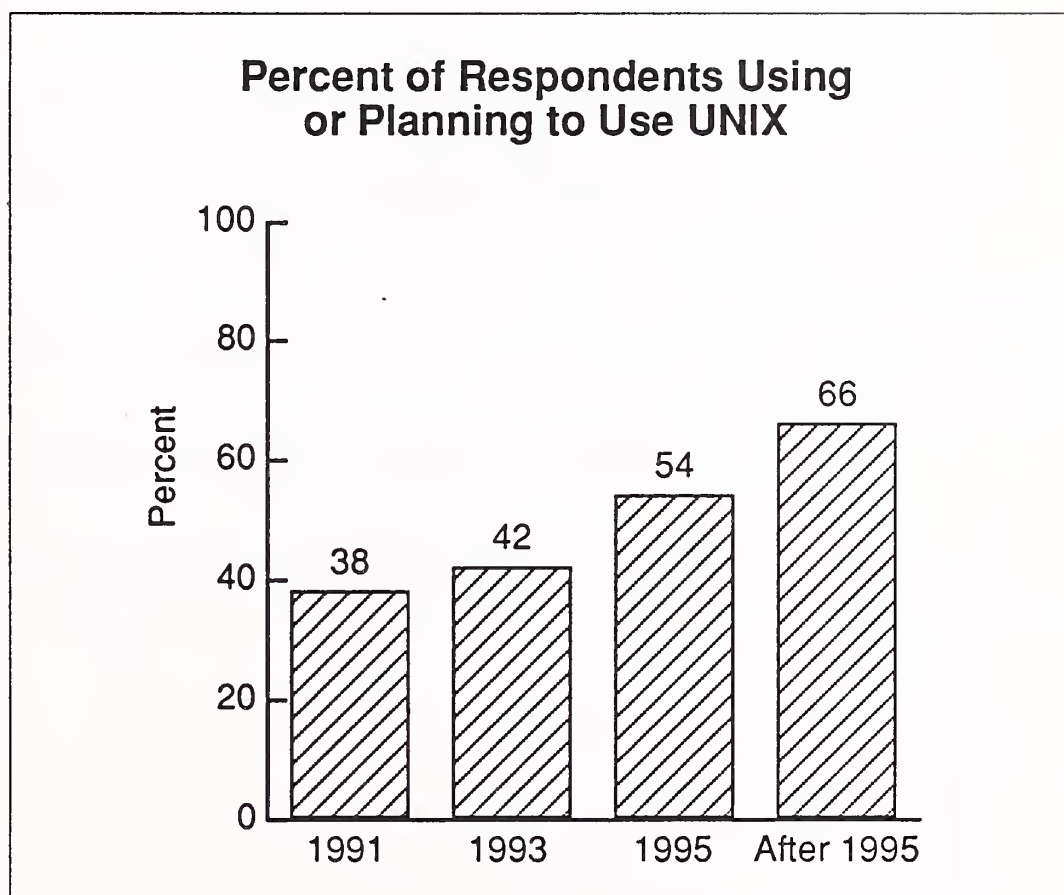
Two standards bodies—UNIX International (which supports System V) and Open Software Foundation (which supports OSF/1) are key. User groups, especially User Alliance for Open Systems (formerly Houston 30) are also developing strong followings. Nonetheless, a complete set of standards is a long way away—perhaps a decade—due to the political nature and complex process of establishing standards.

B

User Requirements, Issues, Trends

As shown in Exhibit II-2, INPUT research revealed that between 30% and 40% of the potential user base currently uses UNIX—either for commercial or engineering applications. The penetration rate is expected to be between 50% and 60% by 1995. Thus UNIX adoption is steady and relatively slow. UNIX *per se* is not a driving force; UNIX is an evolutionary process of product upgrade and/or downsizing.

EXHIBIT II-2



UNIX implementation is a strategic decision rather than an isolated experiment. End users are willing to move away from their primary proprietary vendors for a UNIX solution that fits their needs. Thus competitive positioning will change as vendors grapple to maintain account control and take on new customers as well. Hardware price/performance, is, at least in the short term, a key driver in the selection of a UNIX vendor. As the workstation market shakes out over the next several years and workstation prices become more stable, the reasons for vendor selection will shift more strongly to software and services.

Generally speaking, user success with implementing UNIX is high. Applications development with UNIX is a key advantage and it is where most of the perceived success has been. Lack of a single UNIX standard does not appear to be a significant barrier to UNIX purchases. The focus in the application and a great deal of emphasis is being placed on downsizing, rather than "openness." Given this fact, lack of applications software is a barrier to UNIX adoption in the short term.

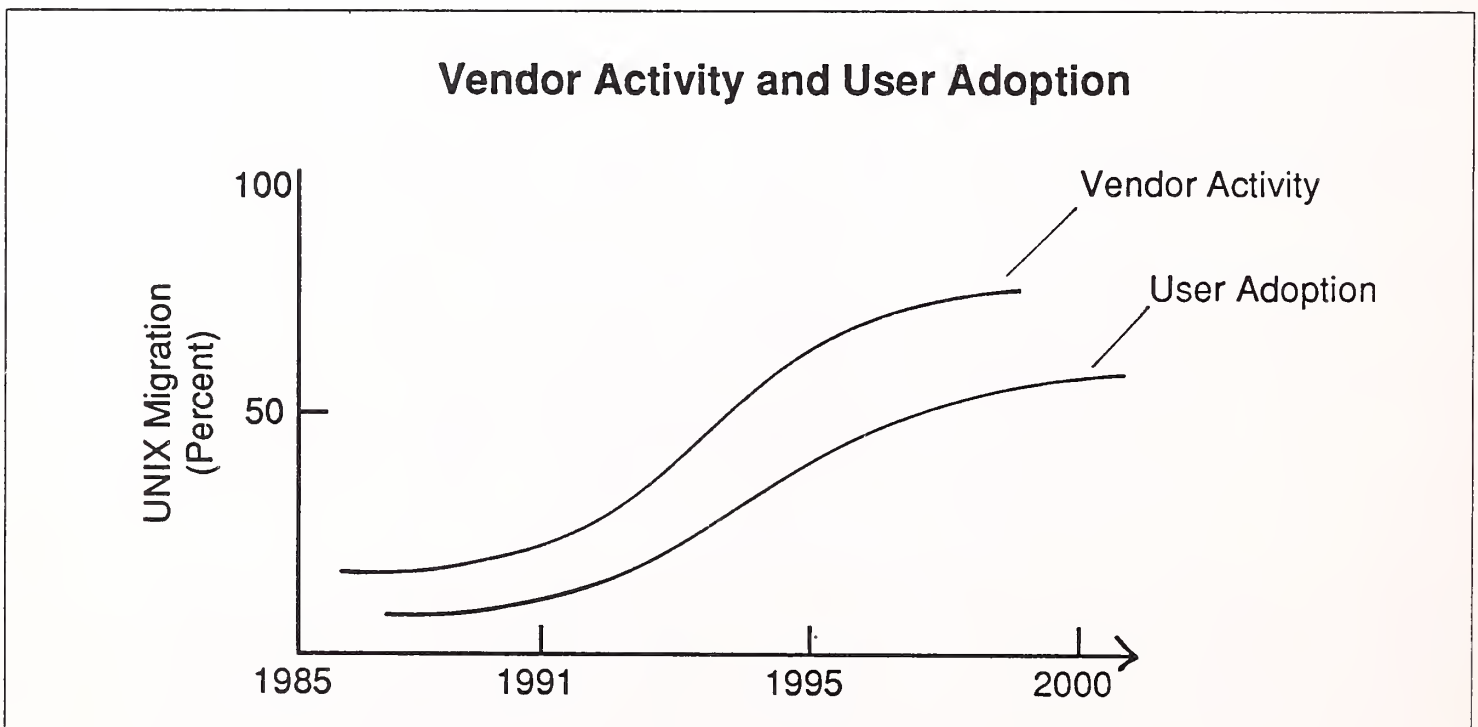
C

Competitive Analysis

All of the components necessary to make UNIX a viable operating system in the commercial arena are not fully formed. However, a level of vendor commitment and planning is present that did not exist even one year ago. Large systems and software vendors are adding to the momentum. Notable examples include IBM's success with its RISC workstation and NCR's total move to a standard UNIX platform. Large applications software products vendors and services firms will follow.

As Exhibit II-3 shows, however, user acceptance will drag behind vendor activity. UNIX will remain a difficult selling environment over the next several years. Nonetheless, as the traditional vendors commit to open systems, larger numbers of users will eventually follow.

EXHIBIT II-3



Vendor migration to UNIX and open systems is a tremendously costly undertaking and only the very large vendors can sustain both proprietary and "open" strategies. UNIX directions have been announced and strategies are in place. How effectively and quickly each vendor implements its strategies remains to be seen.

Many transitional issues are surfacing. To protect their proprietary installed base, vendors are beginning to add "openness" by meeting POSIX standards and X/Open certification requirements.

Although the UNIX evolution poses large challenges for vendors, many exciting opportunities exist. Value and differentiation will be added through service and software and through enhancing hardware technology. UNIX represents an opportunity for systems and software companies to leverage their R&D dollars and to bring out new and better technologies.

D

Market Forecast

UNIX products will play a role in all three systems software product categories, as shown in Exhibit II-4. Nonetheless, by 1996 UNIX will still only account for a relatively small percentage of user expenditures on systems software. The UNIX share of the total spent on systems software in 1991 is 8%, forecast to grow to only 13% of the total by 1996. Thus proprietary systems software products will remain a healthy business for some time to come.

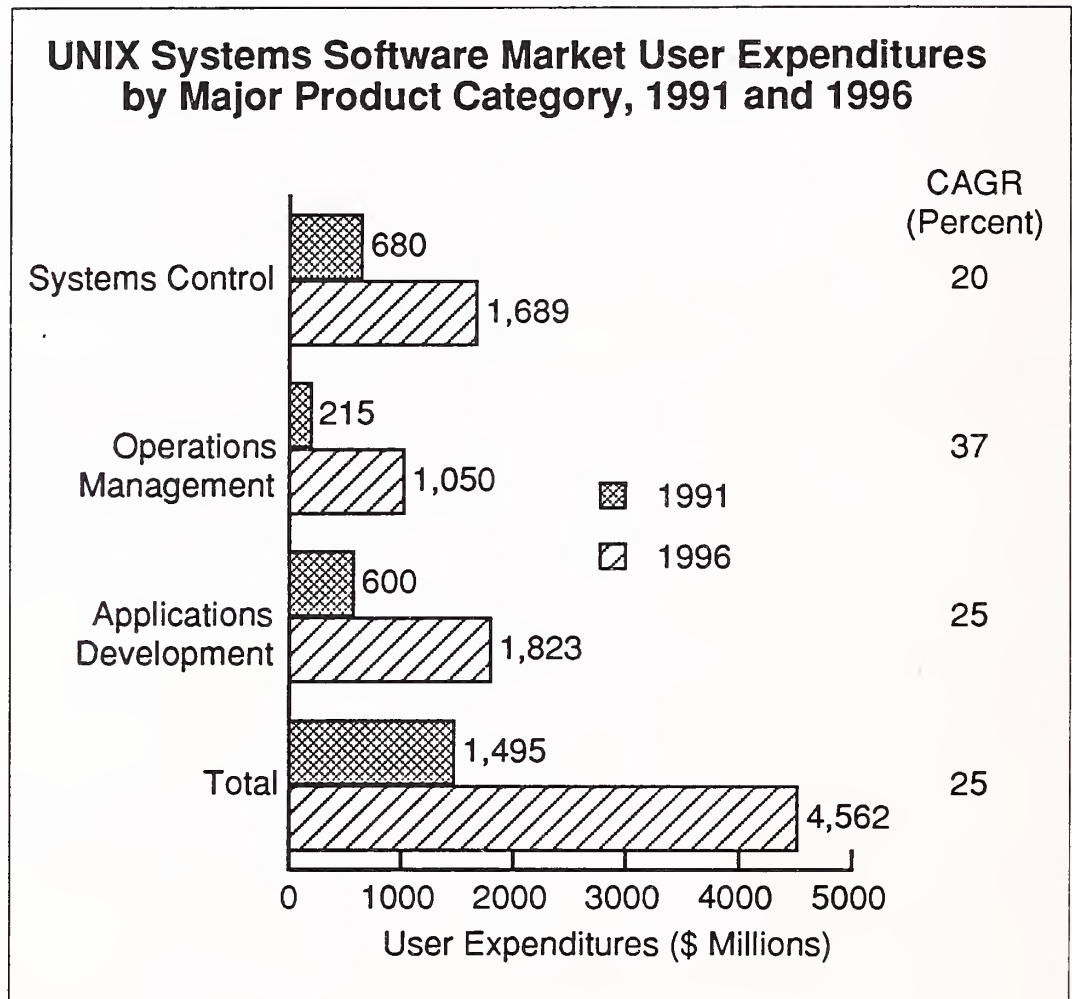
EXHIBIT II-4

UNIX Share of Systems Software Products Market by Major Product Category, 1991 and 1996

	\$ Millions						1991-1996 CAGR	
	1991			1996				
	UNIX	Total	% UNIX	UNIX	Total	% UNIX	UNIX	Total
Systems Control	680	6,800	10	1,689	11,500	15	20	11
Application Development	600	7,400	8	1,823	16,900	11	25	18
Operations Management	215	4,100	5	1,050	7,500	15	41	13
Total	1,495	18,300	8	4,562	35,900	13	25	14

Even though UNIX's share of total systems software will remain relatively small, the U.S. market for UNIX-related systems software is growing almost twice as fast as the systems software market as a whole. Exhibit II-5 shows that the U.S. market for UNIX systems software is forecast to reach \$4.6 billion by 1996. The compound annual growth rate of 25% compares with a forecasted CAGR of only 14% for the whole systems software market.

EXHIBIT II-5



The UNIX market is driven by the advantages UNIX has to offer, level of vendor endorsement, product availability and level of user interest in UNIX. UNIX has solid advantages, the strongest one—interoperability—not being fully realized until after 1995. All large systems vendors are making a concerted move towards UNIX and adopting UNIX standard operating system kernels. However, they are not by any means giving up on their proprietary systems. Users are in large measure waiting for the go-ahead from systems vendors and are seeking direction as to what to do about UNIX.

The market for UNIX-based systems software in Western Europe is forecast to reach \$2.8 billion by 1996, about half the size of the U.S.

market. Although the European market potential is considerably smaller than the U.S., Europe is ahead in terms of UNIX implementation. Nonetheless, even by 1995, the UNIX segment of the systems software products market in Europe will still be dwarfed by products for proprietary operating systems. UNIX systems software products had penetrated the non-mainframe market by 11% in 1990, and should increase to a 15% penetration level by 1995.

UNIX will impact not only systems software, but all information services delivery modes, leading to significant vendor restructuring as software and services start to dominate user budgets and spending decisions. The delivery modes most impacted by UNIX will be turnkey systems vendors/VARs, applications software products, systems integration and professional services.

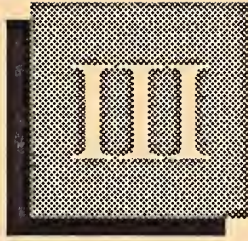
E

Conclusions

Many business issues and technology developments are coming together to make the market receptive to UNIX. However, what is necessary for broad-scale UNIX implementation is more and better vendor preparation, resolution of interoperability issues, more systems and applications software products, more fully developed distribution channels and support services and, last but not least, more customer understanding of UNIX.

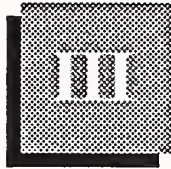
Thus, although user expenditures for UNIX systems software products are expected to increase at the rate of 25% compounded annually over the next five years, UNIX will only have penetrated 13% of the systems software market by 1996.

Competitive pressures between vendors stimulated the original demands for UNIX, and the UNIX marketplace is still in a technology push rather than a market pull situation. Systems vendors are beginning to make a fundamental shift from closed to open systems. Such a transition takes time and talent. With this movement by large vendors, broader full-function software products will be available by 1993-1995. Large vendors will have to learn to truly sell UNIX systems in addition to their proprietary software technology. How to sell both and not confuse the client any further is a challenge that has yet to be adequately addressed.



UNIX Background





UNIX Background

A

Business Issues and Trends Impacting UNIX

Undoubtedly the attraction of UNIX, and the broader area of open systems, is lower costs and improved efficiency from both the user and vendor perspectives. Exhibit III-1 outlines five converging trends—from the user and the vendor perspective—that are creating an environment ripe for UNIX.

User organizations have an obvious need to integrate disparate hardware and software. Multiple technologies are creating redundancies and inaccuracies. Overlapping and incompatible systems often present too many “versions of the truth,” varying results for the same request for information from two sources. Standards, including a standard UNIX, will help solve this problem.

EXHIBIT III-1

Business Issues and Technology Trends Impacting UNIX

- Inefficient islands of technology persist
- Increasing complexity of software development
- Desktop price/performance advantages soar
- Systems vendors' profits at all-time low
- Applications software products vendors seek new opportunities

Complexity of software development is increasing due to integrated applications, enterprise computing, distributed/cooperative processing, and the eventual need to bring software in line with standards. Software complexities are not only plaguing user organizations; applications software products companies are also reeling with the weight of demanding projects. For example, when Lotus Development Corp. set out a few years ago to create a major upgrade of its 1-2-3 spreadsheet, it missed its original completion target by a year. IBM's ambitious OfficeVision is running more than a year behind schedule. And Ashton-Tate still hasn't recovered fully from the delay of its dBase IV data base program.

The need to improve software development productivity will drive the need for standards, and because UNIX is the closest thing to a standard operating system, its growth is assured. It will also drive the demand for a programming language that is easier to deal with.

Lower cost is the primary driving force behind the trend of organizations to decentralize their businesses and downsize their computer operations. The cost of raw computing power on the desktop has dropped much faster than the cost of boosting computing power on midrange and mainframe systems.

Advancements in complementary metal oxide semiconductor (CMOS) microprocessor technology are pushing down the cost of desktop computing and are developing at a faster rate than ECI-based microprocessor technology that many mainframes use. Users can expect CMOS technology advancements to lead to a doubling of system performance every two years.

RISC (reduced instruction set computing) became a major commercial force by the end of the 1980s. Instead of putting complex functions into hardware, the RISC philosophy emphasizes efficient software. RISC technology has established a strong hold supporting UNIX implementations, with the market believing that RISC has a longer development lifetime than conventional CISC processor architectures.

At the same time, networking technologies deliver such power that a properly configured network of desktop systems equals or outperforms many bigger standalone systems. Decentralization and downsizing will accelerate as networking becomes more powerful and sophisticated.

Traditional mainframe and midrange computer vendors cannot keep up the pace of price/performance improvements without damaging their profitability. They are under increasing pressure to find new ways to maintain customer loyalty and to carry less overhead.

In the face of open competition for hardware, many equipment vendors have adopted a strategy of building up their software and services revenues and of holding onto key customers by managing large systems integration projects for them. As an example, 41% of Digital Equipment Corp.'s revenue last fiscal quarter was from software and service.

Revenue growth in the last several years has been in a respectable 20%-25% range for publicly held applications software firms. A large portion of this revenue growth is due to continued acquisitions and industry consolidation, growth in international sales (Computer Associates' net income from foreign operations was 28% of the total for 1990; Microsoft's international sales were 55% of total fiscal 1990 revenues; and Oracle's international sales are 49% of total revenues), and increasing emphasis on professional services.

Thus the bulk of applications software vendors' revenue growth is not necessarily due to growth in applications software products themselves. These companies therefore must seek ways to leverage their development efforts and costs and expand the markets for their products.

B

UNIX

UNIX, created in 1969 by two AT&T researchers, is loosely based on Honeywell's MULTICS mainframe operating system. From 1969 until the mid-1980s, UNIX's growth and enhancements had been spurred by efforts at AT&T Laboratories and two universities—California at Berkeley and Carnegie Mellon. Berkeley created the Berkeley Software Distribution (BSD) version while Carnegie Mellon, working with the Department of Defense Advanced Research Projects Agency, created its "Mach" multiprocessor version of UNIX. Now all major hardware and software vendors have versions of the UNIX operating system, and many niche players are getting on the bandwagon.

Interoperability and portability are the key UNIX advantages. The productivity improvements and efficiency gains are obvious: it protects buyers' investments in hardware, software, and training.

Goals of interoperability and portability include:

- Ability to develop a single application software product that can be used across multiple platforms
- Ability to access data on any system from a single desktop using the same user interface

- Ability to reinstall applications software products without having to recompile and redistribute whenever a new version or release of an operating system occurs

Interoperability and portability are enhanced through application binary interfaces, applications programming interfaces and standards.

Although application binary interfaces (ABIs) are available today, they are only part of the solution for running applications on heterogeneous hardware and reinstalling them without recompilation. ABIs are still operating system and processor dependent; therefore they can only be ported across a single architecture such as 386, 486 or SPARC machines.

The System V.4 ABI represents a tremendous step forward in providing a common ABI. Adherence to the ABI does not, however, assure that any application that executes on one ABI-compliant system will execute on another. Nor does it fully consider interfaces to graphical user interfaces, window systems, data base query commands, and networking protocols.

UNIX comes in a wide variety of forms. Equipment vendors have found it extremely difficult to break their old habit of seeking competitive edge through unique extensions of the operating system. The specification of ABIs for each basic processor chip set promises to allow software product developers to create "shrink-wrapped" versions of their product that will run unchanged on a wide range of equipment. At present, they have to test each version on its target machine before being sure that it will run reliably.

The world of open systems promises to open up application programming interfaces (APIs) so that applications software products can communicate with each other, no matter what their histories.

Ability to access data on any system from a single desktop is simplified through graphical user interfaces such as the X Window System and OSF/Motif, but data files are not easily portable from one machine to another, and system administration tools are needed that manage interconnections among numerous hardware and software components, including data bases and files.

Other key ingredients to interoperability and portability are OSI and TCP/IP. The U.S. Department of Defense, through its Advanced Research Projects Agency, largely funded the work that went into defining TCP/IP and other protocols that rely upon it. In addition, the International Standards Organization authorized projects for a set of communication protocols known as Open Systems Interconnect (OSI). This work, parent of the now famous seven-layer model, laid the groundwork for pervasive communications in heterogeneous environments. While TCP/

IP has been very important in the past several years, many people believe that its importance is decreasing as OSI implementations become available. Regardless of the outcome, these two collections of communication tools brought the dream of portability and interoperability closer to reality.

To a large degree, however, interoperability products on the market today do not or cannot address the issues of broad-based standards, ABIs, APIs and system administration. The technology and products simply do not exist yet, which means challenge and risk as well as opportunity for UNIX users and vendors alike.

C

Standards

Standards allows systems and applications software and information to go across different sized platforms and different vendors' platforms. Without standards, interoperability across heterogeneous platforms won't work.

1. Standards Status

The early popularity of UNIX in universities and research laboratories was followed by its use in powerful workstations aimed at technical and engineering markets. These early technical and engineering environments did not demand the stringent integrity, performance, or applications complexity common to the larger commercial applications.

Thus, in their efforts to attract commercial users, i.e., nontechnical departments, vendors enhanced their versions of UNIX to meet these more critical requirements. In doing so, they reduced the chances of achieving a standard UNIX.

It's a tug-pull situation as vendors grapple with standardizing—by adopting either the UNIX System V or the OSF/1 operating system kernel as a standard—versus adding unique features to meet user requirements and to differentiate.

It is interesting to note that some software and systems vendors have been able to relatively easily migrate their products to UNIX, since complete operating system environments such as Mumps and PICK are available and well proven running on top of and concurrently with UNIX systems.

Exhibits III-2 and III-3 show where the most and the least standards progress has been made.

POSIX standards, developed by the POSIX committee of the IEEE, comprise a layer on top of the operating system that defines the interface between applications software and the UNIX operating system. POSIX's goal is to support portability of applications software products across

diverse machines. The federal government specifies UNIX and/or POSIX in the majority of its Requests for Quotes. Most UNIX vendors, including AT&T, have modified their UNIX operating systems to be POSIX compatible.

EXHIBIT III-2

Standards Progress

- POSIX standards
- XPG3
- OSF/1 and System V.4 operating system kernels
- OSI interconnection protocols
- X Window System and Motif

EXHIBIT III-3

Areas Where Standards Progress Needed

- Integrated data bases
- Networking technology
- Windowing software
- Object-oriented architectures
- Transaction processing

XPG3 is a suite of specifications designed to minimize the problems of porting software between different UNIX-based hardware. OSF/1 and System V.4 operating system kernels have become de jure standards. X Window System and Motif are also de jure standards.

Although progress is being made, a complete set of standards is a long way off. Progress is inhibited by politics and the inherent complexity of the standards-making process.

2. Standards Bodies

There are three well-known standards bodies associated with UNIX—UNIX International (UI is part of AT&T); OSF, representing an alternative camp of vendors; and X/Open Company. Paradoxically, none of them is a recognized international standards body such as CCITT, ANSI, or IEEE. However, their pronouncements and public quarrels do have a strong influence on the market. For example, many critics are unsure whether OSF was created to stimulate the availability of UNIX products or to put the brakes on and slow down the rapid rate of adoption of AT&T products.

At present, UNIX International is scrambling as OSF continues to garner increasing support.

Each organization is discussed below:

- **UNIX International (UI)**—UI, profiled in Exhibit III-4, was formed by AT&T with support from Sun Microsystems to provide product direction to UNIX Systems Labs (USL) and its new versions of its UNIX SVID (System V interface definition). USL was formerly an AT&T division.

EXHIBIT III-4

Profile: UNIX International

Founded:	May 1988
Locations:	Parsippany, NJ; Boston; Los Angeles; Tokyo; Brussels
Goals:	Set product and technology directions for System V operating system
Work Groups:	Multiprocessing; security; user interface; distributed systems
Members:	Most of the traditional and newer midrange vendors Many of the leading UNIX systems software vendors

In response to continued criticism that UI is not independent of the telecommunications giant, AT&T is seeking to place up to 30% of the ownership of UI with member companies. UNIX International is struggling to maintain viability.

- **Open Software Foundation (OSF)**—OSF, profiled in Exhibit III-5, was founded as a defensive response to AT&T's dominance of UNIX and UNIX International.

OSF's position is that standards must involve all players and be vendor neutral. Therefore a major distinction between OSF and UI is that OSF solicits technology from industry, whereas UNIX International is perceived as a cheerleader for AT&T's System V. OSF is not controlled and owned by a single company.

OSF has proven its role as a catalyst or accelerator for bringing technology into the market (e.g., Motif) and into the distributed management environment. It has over 200 members worldwide, with commitments from IBM, Digital, Groupe Bull, Hewlett-Packard, Siemens, Nixdorf Information Systems, Hitachi, Unisys, NCR, Intel, Motorola, Apple Computer, Sun, Encore Computer, Intergraph and other major hardware vendors. Leading software vendors have also endorsed OSF technology.

EXHIBIT III-5

Profile: Open Software Foundation

Founded:	November 1988
Locations:	Cambridge, MA
Goals:	Based on member input, promote and develop standard UNIX software products
Technology Emphasis:	Application/data base interface Operating system Advanced system extensions
Members:	Around 40 major computer manufacturers, including IBM and DEC. Over 200 members worldwide. Many OSF members are UI members also.

OSF has announced its first version of UNIX: OSF/1. IBM, Digital, Hewlett-Packard, Groupe Bull and Nixdorf Computer AG are among those who have made commitments to use OSF/1 as their preferred UNIX operating system kernel.

- **X/Open**—This organization, profiled in Exhibit III-6, defines interfaces and environments to achieve portability. Common Applications Environment is a series of specifications, which, if followed, promote portability.

Since both OSF and UI are members, X/Open is a pivotal organization. X/Open reports a membership of over 300 vendors of similar description to OSF. The list of members includes the major Japanese computer systems vendors. X/Open also has an established council of end users. Although this is a separate advisory council, rather than including end users on specific committees, the breadth of industries represented may provide a solid "sanity check" on vendor and software developer plans.

EXHIBIT III-6

Profile: X/Open Company, Ltd.

Founded:	1984 (Incorporated 1987)	
Locations:	London; Stamford, CT; San Francisco; Tokyo	
Goals:	To bring greater value to users through practical open systems implementation	
Members:	AT&T	NEC
	Bull	Nokia Data
	DEC	Olivetti
	Fujitsu	Philips
	Hewlett-Packard	Prime
	Hitachi	Siemens Nixdorf
	IBM	Sun Microsystems
	ICL	Unisys
	NCR	
	UNIX International	
	Open Software Foundation	
	More than 100 software vendors worldwide	
Verification:	Software suite from Unisoft Group (London; Cambridge, MA; Emeryville, CA; New York; Tokyo)	

X/Open has adopted two key roles on behalf of its members:

- A central information source on the meaning and status of open systems standards
- The identification of priorities for new areas of open systems standards development

The detailed results of its research into priorities are published by X/Open in *The Open Systems Directive - Shaping the Future of Open Systems*. This provides an extensive overview of the technical requirements relating not only to UNIX and the software it supports, but to many other important open systems issues. X/Open is managing programs covering:

- Marketing and Communicating Open Systems Information
- Operating System Interfaces
- Operating System Commands
- Security
- Systems Administration and Management
- Human/Computer Interface
- Networking and Communications
- Distributed Applications
- Transaction Processing
- Application Development Environments
- Object-Oriented Management
- C Language
- COBOL
- Data Interchange
- Standards Verification

X/Open publishes Portability Guides covering many of these topics to help users establish standards and strategies that will ensure maximum compatibility between software and systems from different suppliers.

3. User Groups

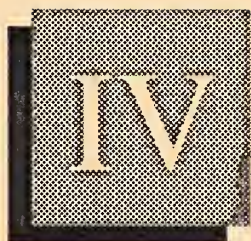
One effect of the slow progress in and uncertainties surrounding standards has been the creation of a number of pressure groups among user communities. A variety of pressure groups have been formed by like-minded users to balance the proliferation of vendor consortia which are primarily concerned with vendors' interests.

Undoubtedly the strongest reaction from users has been the forming of the User Alliance For Open Systems (UAOS), profiled in Exhibit III-7. This organization was originally called the Houston 30 and it issued a strongly worded report, "Overcoming Barriers to Open Systems Technology", calling for a global war against proprietary systems. Its main argument was that such systems hold data hostage.

EXHIBIT III-7

Profile: User Alliance for Open Systems (UAOS)

Founded:	October 1990 (Formerly Houston 30)
Goals:	To encourage vendors to offer vendor-neutral products. Overcoming barriers to open systems information technology.
Technology:	Open systems. Specifically those which enhance the ease of sharing information within companies.
Members:	Over 45 multinationals totalling as much as \$75 billion in purchasing power, including Eastman Kodak, DuPont, Exxon, Ford Motor Co., General Electric, General Motors, Hughes Aircraft, McDonnell Douglas, and NASA.



The User View





The User View

This chapter gives an assessment of UNIX from the user perspective. INPUT conducted telephone interviews with 26 user organizations representing companies from eight industries and ranging from Fortune 500-sized companies to relatively small organizations. Each interview was approximately one-half hour long.

The kinds of individuals interviewed were:

- Director, New Technology
- Information Services Manager
- Business Systems Director
- Vice President of Finance Administration
- DP Manager
- MIS Director
- Director of Engineering

The industries represented are:

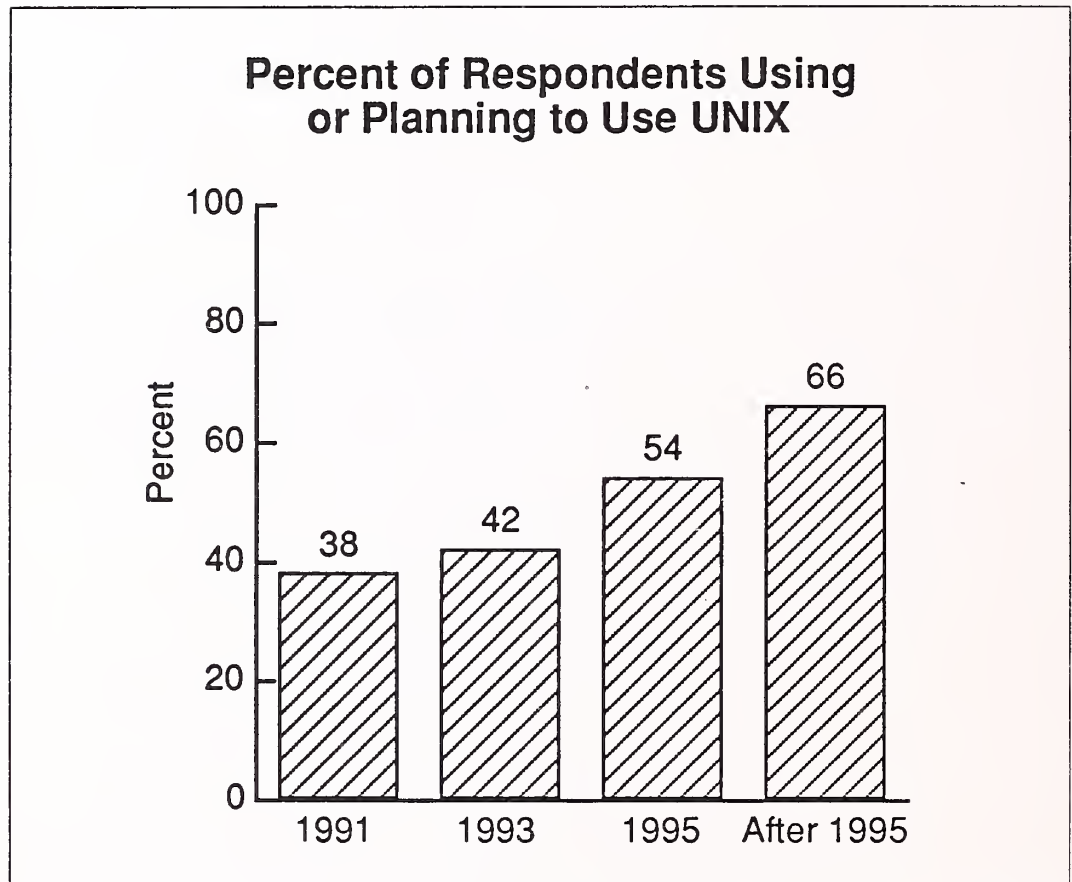
- Banking/Finance
- Discrete Manufacturing
- Process Manufacturing
- Education
- Services
- Wholesale
- Insurance
- Medical

Although the survey results cannot detail attitudes and preferences by individual industry sector, ample information was obtained to accomplish the following:

- Assess current and planned level of UNIX activity over the next several years
- Obtain an understanding of the driving forces on the “demand side” of the UNIX equation

The percentages shown in Exhibit IV-1 are gross level indicators of the breadth of UNIX activity across corporations now, before 1995, and after 1995. The UNIX operating system is being used in ten (38%) of the 26 corporations INPUT interviewed; according to the survey responses, by 1995 the number of corporations in this sample that are likely to be using UNIX will increase to 14 (54%). It is interesting to note that a sizeable percentage (19%) do not, at least at this point, intend to implement UNIX at all, and that another 15% did not answer the question or did not know if and when they would consider using UNIX.

EXHIBIT IV-1



These findings are comparable to findings from research conducted by INPUT in December 1990, which found that 15% of current respondents have commercial UNIX applications and 27% have engineering UNIX applications. Usage, according to the December research, will expand to 32% commercial UNIX usage and 37% engineering UNIX usage by year-end 1992. These percentages are not additive, as any given user could be using UNIX for both commercial and engineering applications.

UNIX expenditures planned for 1991 range from zero to \$500,000. Of those that already have or plan to implement UNIX in 1991, the average planned 1991 expenditure is \$93,000 per company; by 1993 the average planned expenditure for this group will jump to \$386,000—over a fourfold increase.

A

Current Users

Exhibit IV-2 profiles the UNIX user sample by company type, application type, hardware platform and percent of IS budget that will be spent on UNIX in 1991. In the majority of cases the UNIX users are implementing production-level applications fundamental to their businesses. For example, a discrete manufacturer implemented a UNIX-based integrated manufacturing and financial control system; and a financial services firm implemented UNIX-based software for all aspects of its pension planning and portfolio optimization services.

EXHIBIT IV-2

UNIX Users and Their Applications

Company	Application	Hardware Platform	1991 IS Budget (Percent)
Discrete Manufacturer	Integrated manufacturing fin. control system	Unisys minicomputer with 120 terminals	100
Discrete Manufacturer	Call distribution management system	PCs using AIX	<5
University	Network servers, UNIX instruction	Workstations	<10
Business Services Co.	Geophysical data processing	4 Sun workstations	75
Discrete Manufacturer	Data base and project management	450 PCs and workstations	33
Discrete Manufacturer	CAD/CAM	HP workstations	<5
Food Processor	Financial, accounting, human resources	Unisys mini-computer, 40 terminals	75
Services Company	Software development, technical publishing	25 workstations	95
Banking/ Finance Firm	Portfolio optimization	75 workstations, PCs, terminals	80
Process Manufacturer	All DP needs for beverage wholesalers	75 workstations, PCs	Will roll out to all wholesalers

In companies interviewed where UNIX is used in commercial applications, the decision to implement UNIX is strategic rather than an isolated experiment. Thus UNIX's growth in commercial applications is assured.

1. Reasons for Implementing UNIX

Respondents were first asked why they were seeking a new solution. They were then asked what options were considered and why they selected UNIX.

Exhibit IV-3 summarizes the four major reasons corporations in the survey sample are seeking a new solution. The most prevalent reason corporations seek another solution—UNIX or otherwise—is that their hardware and/or software is old and it is time to replace it with something better. The second most prevalent reason is that the applications software or hardware may not have been previously available that could either automate the task or was affordable. Thus UNIX is considered as corporations either upgrade to the next generation of hardware and software or “upsized” to new application solutions that were previously unavailable.

EXHIBIT IV-3

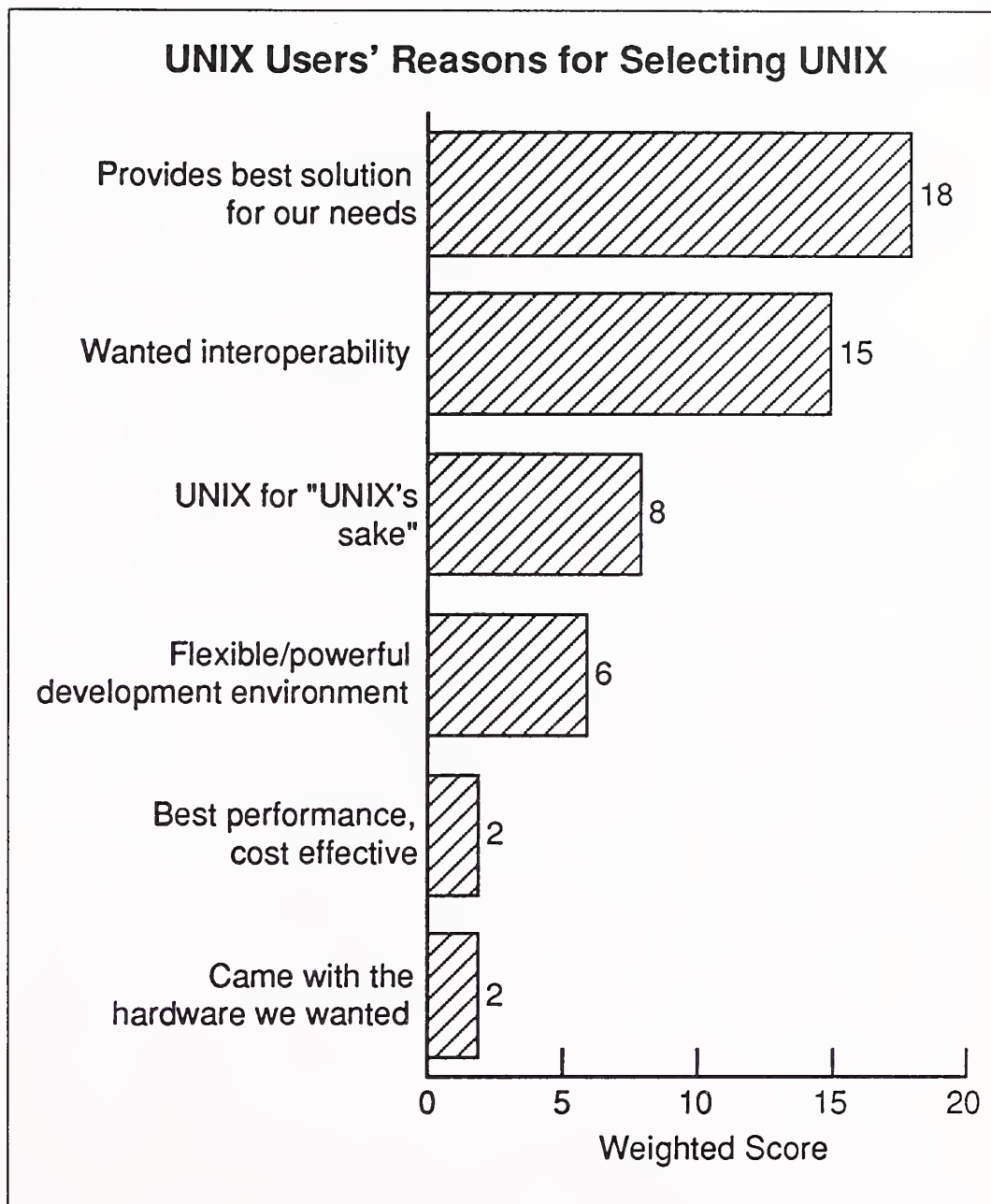
UNIX Users' Reasons for Seeking Another Solution

- Ready to upgrade from old hardware or software
- Previously done manually or not at all
- Ability to share files between heterogeneous hardware platforms
- More efficient programming environment leading to integrated solutions

Lower cost was not mentioned as a reason to seek another solution. Also telling is that interoperability—ability to share files between heterogeneous hardware platforms—and a more efficient programming environment, although still among the top reasons for seeking another solution, are second order reasons. This confirms the theory that UNIX is evolutionary, not revolutionary.

Respondents were then asked to list the three primary reasons for selecting UNIX over the other options considered. Exhibit IV-4 lists reasons, giving a weighted score. (A weighted score is the weight of the reason—first reason given a weight of 3, second reason a weight of 2, and third reason a weight of 1—multiplied by the number of respondents).

EXHIBIT IV-4



According to survey results, the choice of operating system is largely an applications-driven decision. This finding indicates that the availability of applications software that capitalizes on UNIX's unique capabilities—namely its portability, and multiuser and multitasking capabilities—is a critical market driver. Applications software products availability will enhance UNIX adoption by smaller firms that do not have internal development staffs as well as larger firms that do not yet have internal UNIX expertise.

The desire for interoperability is a close second reason users select UNIX-based solutions over other operating systems. Another reason cited for selecting UNIX is the perception that open systems is "the way of the future" and that UNIX is inevitable.

Brief profiles of several respondents' thinking process about purchasing UNIX-based systems follow:

- In addition to proprietary systems running on IBM 4381, IBM AS/400 and DEC 6200, a discrete manufacturer in search of an integrated manufacturing and financial control system considered a minicomputer-based UNIX solution. Although the proprietary solutions were "better known and proven," the Unisys UNIX solution was lower cost and was considered "a better applications software fit."
- A relatively small business services firm in search of a software development platform, technical publishing software, and data base support for customer logs and problem reports reviewed VMS and PC/DOS as well as a UNIX solution. It decided VMS was too large for its needs whereas DOS had insufficient memory, multitasking, windowing and performance management resources. Over a five-year period it has installed Sun, HP/Apollo, Intergraph and DECstation 3100s running UNIX.
- A large foods distributor reviewed its existing primary vendor's proprietary system. Although ease of conversion, the lower cost involved in retraining personnel, and software availability were advantages, another vendor's hardware and UNIX operating system was selected for its long-term cost effectiveness and openness.
- A large beverage manufacturer and distributor selected AT&T's hardware and UNIX operating system over proprietary systems even though with the proprietary solutions it would have been able to use existing software and capitalize on the knowledge of the current user base. The overriding reason to go with UNIX was the desire for standards and an open system.

These profiles reveal that users are willing to switch vendors for the sake of UNIX. It also signifies that a fundamental shift is underway in the systems competitive environment. Hardware price/performance is the primary reason that a specific version of UNIX is selected.

2. Level of Success with UNIX

Users were asked to rate their level of success with UNIX on a scale of one to five, where one is not at all successful and five is very successful. As shown in Exhibit IV-5, overall success with UNIX is high; four respondents (40%) ranked their success with UNIX as 5 and another four (40%) ranked their success level as 4.

EXHIBIT IV-5

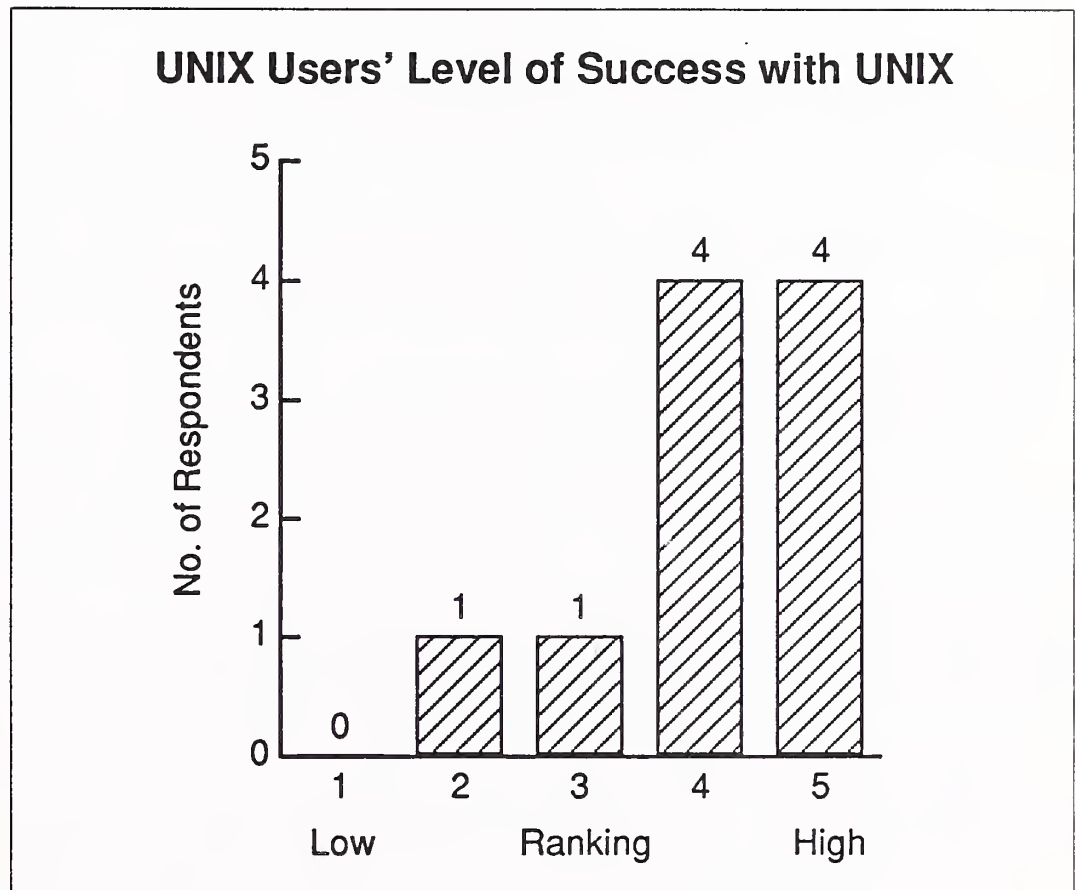


Exhibit IV-6 summarizes what users find the most successful and least successful aspects of implementing UNIX. Although the two primary reasons for selecting UNIX over other options are that UNIX is the “best” solution” and provides interoperability, applications development is where most of the perceived success is. Whether or not the application solution being developed turns out to be the “best” has yet to be determined. Users will next be looking for actual outcomes and results of their UNIX implementations.

Noticeably absent from the list of successes is interoperability. It seems likely that high levels of success with UNIX depend on how rigorous the needs are for interoperability—the less rigorous the need, the higher the level of success.

EXHIBIT IV-6

UNIX Users' Successes and Complaints

- Successes:
 - Applications development efforts (4)
 - Easily portable to other hardware platforms (3)
 - Support of remote sites
- Complaints:
 - Too many versions of UNIX
 - Lack of system administration and integrated CASE tools
 - Lack of knowledge about UNIX and time involved to learn

The complaint voiced most often about UNIX is the amount of time necessary to get up to speed with UNIX and, related to that, the time required for training. One company called UNIX a "tinkerer's dream."

Other complaints about UNIX are its lack of complete systems control and operations management capabilities—specifically file management, tape management, and printer management—and lack of high enough security levels. A large U.S. division of a European automobile manufacturing firm that implemented a UNIX-based call distribution management system ranked its success with UNIX as only a 2 out of 5. UNIX's lack of configuration management capabilities and the difficulties involved with having to support one more operating system created more problems than UNIX solved. This company does not plan to implement any more UNIX.

Nonetheless, even with these complaints, the majority of users perceive their efforts with UNIX as highly successful.

3. In-house versus External Resources

Believing that the use of external services is key to the growth and adoption of UNIX (due to its complexity), INPUT questioned user respondents about their use of external resources, what tasks were performed, and what type of firm was used. The results are:

- Six of the eight respondents used their hardware vendor and/or an independent software vendor for assistance. These vendors provided:

- Connectivity to other vendors' hardware
 - System configuration
 - Application conversion
 - System administration
- A professional services firm or a systems integrator was used by three respondents. The professional services firms reviewed a data base design and participated in program development. The systems integrator corrected operating system faults.
 - On a scale of one to five, where one is inadequate and five is very adequate, five of six respondents ranked the services of outside vendors as four or better.
 - However, the overall percentage of resources spent on employing outside firms was only 27% of the total expenditures.

As expected, these results indicate that involvement by outside services firms is still relatively small; as the size of expenditures for UNIX increases, more involvement by outside services firms will ensue.

B

Non-UNIX Users

1. Reasons UNIX Was Not Selected

Companies that are not UNIX users either have never considered it or considered UNIX and decided against it. It is interesting to compare the responses of these two groups.

Exhibit IV-7 lists the reasons given for not considering UNIX. Of the five respondents that have never considered UNIX, most view UNIX as a replacement for DOS, and they are happy with their PCs and DOS.

The response, "UNIX is too complicated" could indicate that, although companies that previously couldn't afford to automate may now be able to due to lower-cost UNIX-based workstations, the complexity of UNIX may be prohibitive for many unless they hire outside services firms.

Reasons for not selecting UNIX are presented in the following summaries of responses from companies that considered UNIX and, after consideration, decided against it:

- Fortune 500 discrete manufacturing firm—Considered UNIX for manufacturing applications but decided not to use UNIX because it couldn't find a large enough system in terms of processing power that ran UNIX. This company is using an IBM mainframe and MVS instead. This company will consider UNIX again, and wants to downsize, but does not know when.

EXHIBIT IV-7

**Non-UNIX Users' Reasons for
Not Considering UNIX**

- Happy with what we have (3 responses)
- Don't need the power of UNIX
- UNIX is too complicated
- Not enough UNIX applications software
- UNIX is not an industry standard
- Don't know anything about UNIX

- \$950 million insurance company—Considered UNIX for an interactive voice response system but decided not to use UNIX because of lack of applications and technical support. Instead of UNIX, this firm is using PC/DOS, IBM mainframe (VM/MVS) and IBM midrange OS/400 and VMS computers. It will consider UNIX again in the 1993 time frame.
- Large mechanical components company—Considered UNIX for CAD and finite element analysis. Decided not to use UNIX because the company is a DEC shop and when the CAD decision was being made, DEC had no UNIX operating system. The company is using a CAD system running on DEC VMS instead, and will consider UNIX again in the 1993 time frame.
- \$200 million pharmaceutical company—Considered UNIX for a bar code inventory and tracking project, but the applications software vendor never got the software working properly. This firm currently does inventory and tracking manually and will consider UNIX again in the 1993 time frame.
- A boat building firm considered UNIX for MRP, job costing and all of its accounting systems. It decided not to use UNIX because the company found a package that ran on the existing operating system and interfaced with the current engineering system. This company may consider UNIX again after 1995.
- Fortune 500 insurance firm—Considered UNIX for widespread use in insurance applications but decided not to use UNIX because of lack of standards, lack of full-bodied development tools, and because of its dependence on IBM mainframe environments for corporate data (“UNIX still has holes as far as putting it into an IBM SNA and MVS environment”). This company is migrating to OS/2 instead and will consider UNIX again after 1995.

- **Midsized bank**—Considered UNIX for an in-house multiuser worksheet application but decided not to use UNIX because the interface was too complicated. The bank used a PC LAN configuration instead.

It would seem that each company interviewed had a different reason for not selecting UNIX. It is interesting to note that lack of standards is only mentioned once as a reason not to select UNIX. Thus users are not necessarily waiting for a unified UNIX before purchasing.

For this sample of non-UNIX users, UNIX is “in competition with” proprietary operating systems that run on mainframes and minicomputers as well as OS/2 and PC LANs. The nonuser sample—in terms of industry, size and applications—does not appear to be distinguishable from those that did select UNIX. What then is the difference? It could be that the user group was at the end of product life in terms of either their hardware or software and was therefore ready to invest in new gear; or a suitable solution did not exist until UNIX came along.

Adoption of UNIX appears to be at least partially dependent on the degree to which proprietary systems vendors—IBM and DEC—make UNIX an option and encourage their customers to use it. Improved support and good applications software products may also be critical to growth in the adoption of UNIX.

2. Barriers to Implementing UNIX

For further insight into why UNIX was not being selected, INPUT asked the nonusers, “To what extent do you consider the following barriers to implementing UNIX (where 1 = not a barrier at all, and 5 = a large barrier)?” The results are summarized in Exhibit IV-8.

Lack of UNIX expertise, the only barrier with a compound score above 4.0, is the principal barrier to implementing UNIX. Forty-six percent of the IS managers interviewed in this survey feel they do not know enough about UNIX to even consider using it. Although this is the largest barrier, lack of adequate training (2.8) and support (2.4) are not perceived as inhibitors to the adoption of UNIX. Either vendors have not actively sought to educate their customers about UNIX, or potential users have not sought out education about UNIX from their vendors.

The second major barrier—as indicated earlier—is that needs are adequately met in other ways. Specific comments include: “If someone could show me it’s a better operating system than what we have...(we would be interested).” And “(We would be interested if we could get a) serious commitment from IBM that UNIX is the right thing to do.” This is really a corollary to the fifth-ranked barrier—not wanting to give up installed base of hardware and software—which, in turn, is closely related to user concerns about the difficulties inherent in integration.

EXHIBIT IV-8

Non-UNIX Users' Barriers to Implementing UNIX

Reason	Compound Score
• Lack of UNIX expertise	4.2
• Needs are adequately met in other ways	3.9
• Integrating UNIX with proprietary systems is too difficult	3.8
• Lack of applications software products	3.7
• Do not want to give up installed base of existing software and hardware	3.6
• Not enough performance management functionality	3.4
• Not economically justifiable	3.3
• Lack of standards	3.2
• UNIX is too complicated	3.2
• Network software not sophisticated	2.9
• Lacks applications portability across heterogeneous platforms	2.9
• Too many implementation problems	2.8
• Adequate training unavailable	2.8
• UNIX software is too expensive	2.7
• Internal political issues	2.6
• Adequate maintenance/support unavailable	2.4

1=not a barrier at all; 5=a large barrier

The third largest barrier is the perception that integrating UNIX with proprietary systems is too difficult to even attempt.

Lack of applications software products is the fourth-ranked barrier with a score of 3.7 out of 5. Users would consider UNIX more seriously if more applications software products were available; if the software was lower cost with equivalent or better features or functions than what's used today; and/or if it was easier to use than the current application solution.

Respondents indicated lack of standards as only an "average" barrier, garnering a 3.2 rating. On the other hand, integrating UNIX with proprietary systems is high on the list of barriers, with a 3.8 rating. Thus UNIX users are not delaying UNIX purchases because of lack of a single unified UNIX product; they may not care how many different variants of UNIX there are as long as the type they select can interoperate with the proprietary systems they already have in place. Portability across multiple vendors' platforms is therefore less important than portability across their primary hardware vendors' platforms.

Exhibit IV-9 outlines the reasons users are happy with what they have and points out additional barriers to UNIX implementation.

EXHIBIT IV-9

Non-UNIX Users' Advantages of Current Operating System Over UNIX

- Applications software advantages
 - Applications software products readily available
 - Supports current software selections
- Hardware advantages
 - Runs on existing hardware (2)
 - Connects to existing IBM network
- Ease-of-use advantages
 - Everyone knows it
 - No additional training needed
 - Straightforward operating system
 - Easier interface to other systems

C

Summary

Between 30% and 40% of the potential user base is currently using UNIX, both for commercial and engineering applications. UNIX's penetration will be in the 50% to 60% range within the next three to four years.

In the companies INPUT interviewed, the decision to implement UNIX for commercial applications is strategic and the intent is to continue to implement UNIX in environments where it makes sense. Thus, although the penetration rate for UNIX is still small, its growth is assured. UNIX is generally considered when applications seem suited for it, rather than being sought out for its own sake. In addition to replacing a previous application solution, UNIX is also addressing market needs that were previously unmet, thereby expanding potential overall user base.

End users are willing to move away from their primary proprietary vendors for a UNIX solution. Competitive positioning will change as vendors try to maintain account control and take on new customers as well. Hardware price/performance is, at least in the short term, a key driver in the selection of a UNIX vendor.

Most of the perceived success with UNIX has been in applications development. Users will next be looking for results from their UNIX implementations. Time involved in getting up to speed with UNIX is the major complaint and lack of UNIX expertise is the largest barrier to UNIX implementation. These findings signal a large potential market for professional services.

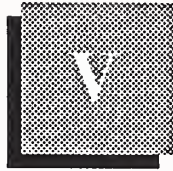
Lack of a single UNIX standard is not a major barrier to initial UNIX purchases. The focus is the application rather than UNIX's "openness." Given this fact, lack of applications software *is* a barrier to UNIX adoption and signals a large potential market for UNIX applications software products.

UNIX is by no means taking the world by storm and many corporations believe their needs are already adequately met. Thus UNIX *per se* is not a driving force; UNIX is more an evolutionary process of product upgrade and/or downsizing.



The Vendor View





The Vendor View

A

Industry Structure

The commercial UNIX marketplace is taking on an industry structure paralleling that of proprietary software. The UNIX software industry will become dominated by major systems manufacturers; major systems and applications software products companies will be second in command, and opportunities will abound for niche players who will form alliances with larger systems and/or software products vendors. Third-party distribution companies—VARs and OEMs, systems integrators and professional services firms—will play a key role in the spread of UNIX.

Unlike the traditional or mainstream software products industry, however, a new breed of hardware vendors—which have been largely responsible for the birth of commercial UNIX—will play a pivotal role as market drivers and as a distribution channel for UNIX software. These companies provide computers that incorporate advanced microprocessor technologies and include Compaq Computer Systems, Mips Computer Systems, Pyramid Technology, Sequent Computer Systems and Sun Microsystems. Some of their products, such as Compaq's SystemPro, are PC-compatible, yet have multiple CPUs, run UNIX, support gigabytes of storage, and support many users.

In addition, because of the emphasis placed on “open systems” rather than on UNIX *per se*, another twist in the industry structure will be more, and more variation of, alliances between would-be competitors who are working together to develop interoperability schemes.

- For example, IBM and Hewlett-Packard are submitting a joint response to the OSF request for technology to create a Distributed Management Environment, a systems management scheme for the OSF/1 operating system.
- Another notable example is Hewlett-Packard's and Sun Microsystems' joint submission of an object-oriented technology to the Object Management Group.

- Another new alliance, with a direct impact on systems software, is between Microsoft, DEC, Compaq and Mips to define and develop a new RISC-based open systems platform.

Technology solutions are complex, making it difficult for small systems and applications software companies to succeed by themselves. The UNIX operating system is a small part of the open systems challenge. Applications software, software development tools, data management, networking and user environment technology challenges abound. A vendor must have a large infrastructure, ample capital, and/or numerous alliances.

B

Level of Vendor Involvement

Over the last six to eight months, leading midrange vendors have moved from begrudgingly providing proprietary UNIX if users request it; to endorsing UNIX as a viable option; to endorsing a standard operating system kernel; to moving fully in the direction of "open systems" where UNIX is one piece of the whole; to total product line migration to UNIX (NCR). These companies are not only endorsing integration of UNIX with their proprietary systems but they are also beginning to endorse interoperability with other vendors' systems.

IBM as well has begun to change its tune, although not quite as enthusiastically as the midrange vendors. Its recently announced strategy is to incorporate the OSF/1 kernel into AIX; whereas before, AIX was IBM's own proprietary version of UNIX. Although IBM is not encouraging interoperability with other vendors' hardware, it will integrate AIX under the SAA umbrella, thereby making it interoperable with OS/2, OS/400, VM and MVS environments (see IBM profile below).

In addition to large systems vendors, all other types of vendors are beginning to announce UNIX plans and make products available. Large independent software vendors, such as Computer Associates, are publicly announcing UNIX plans, and for some—such as Oracle—close to 50% of revenue now comes from UNIX software products. Clearly, the march to UNIX and open systems is gaining momentum.

Exhibit V-1 shows expected timing of sufficient marketwide availability of commercial UNIX systems and applications software products.

1. Systems Vendors

As large systems vendors migrate to UNIX, they have begun a complete reversal from the once-cherished strategy of locking in the customer and locking out the competition. This reversal brings with it a number of difficult challenges, summarized in Exhibit V-2.

The balancing act between proprietary/differentiation and "open"/standards is being played out in the following ways:

EXHIBIT V-1

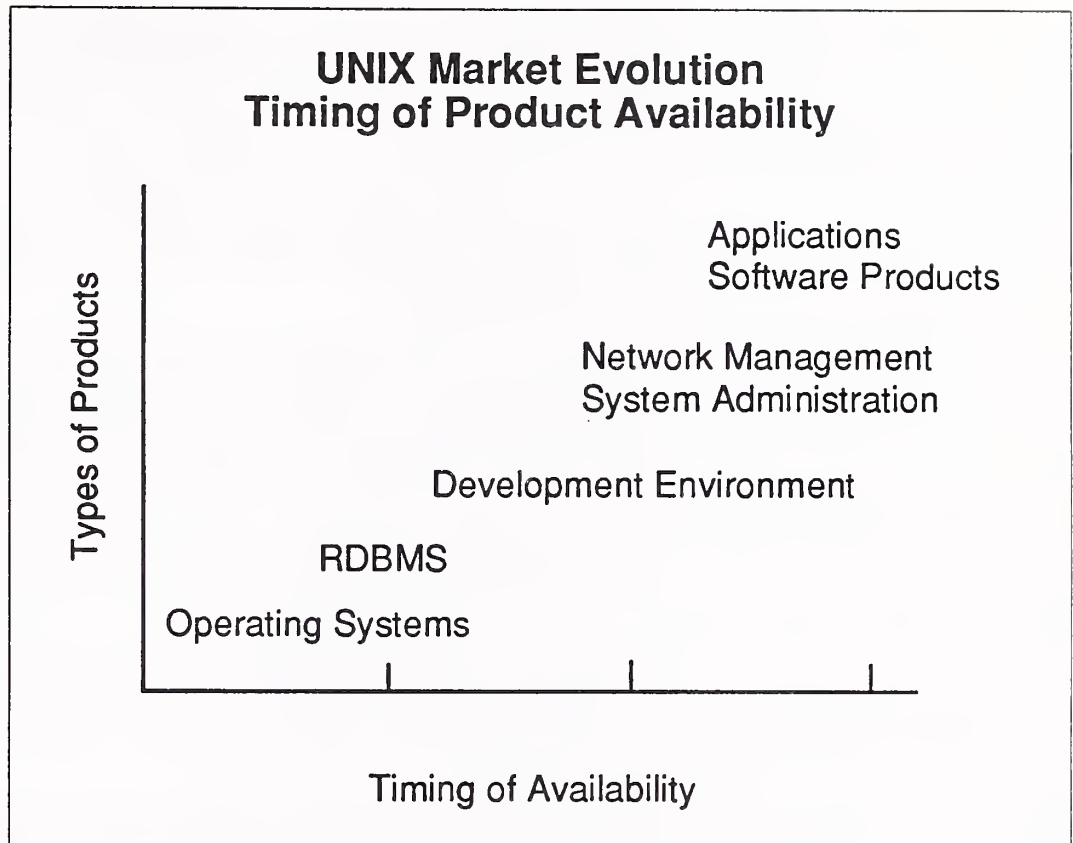
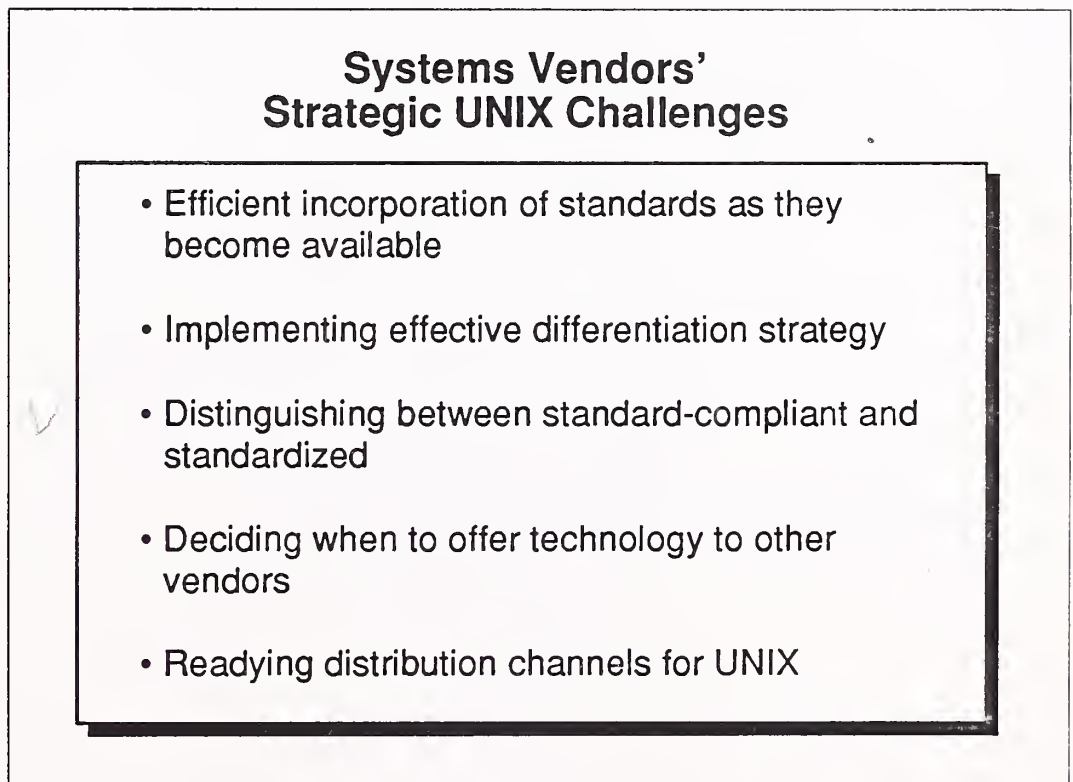


EXHIBIT V-2



- Being efficient about integrating a standard operating system kernel into an existing product set. Vendors are learning that they can't spend too much time and money on making a standard better or different, because it will most likely change.
- Implementing a differentiation strategy that sets a vendor apart, yet not too far apart. Examples of degrees of differentiation vendors are employing are:
 - Enhancing the operating system kernel with added-value systems control capabilities. Eventually these added-value features may be sold as add-ons to the operating system kernel so that if users want to purchase a standards-only operating system, they can.
 - Providing own enhanced "flavor" of UNIX such as Microsoft's NT kernel and SCO's XENIX.
 - Targeting vertical industries and applications such as Unisys' pursuit of financial and retail distribution industries with a UNIX-based OLTP product.
 - Providing additional UNIX technology capabilities such as image processing (Unisys) and multimedia (DEC).
 - Providing hardware price/performance advantages. This differentiator, however, will always be a short-lived advantage due to the rapid pace of technological improvements in microprocessor technology.
- Getting the message across to the marketplace that there's a distinction between standard-compliant and standardized products, thereby allowing room for differentiation within a standard-compliant framework.
- Another challenge facing vendors is deciding whether, and when, to make their internally developed technology—which on one level could give them a competitive edge—available to other vendors through submission to standards bodies. The advantage of sharing technology is that it creates a broader market. Also advantageous is being first to market with a new technology that will later have broad market appeal. Another advantage is enhancing marketplace perception that one's firm is committed to standards and open systems.

Technologies that will be most often shared are the ones that standards groups are emphasizing. Among technologies the OSF emphasizes are application/data base interfaces and advanced system extensions.

- Readyng the distribution channels for new technologies and new pricing structures. Hardware will be different—it will be smaller—and the accompanying software will be not only lower priced, but more

complex. Thus, more service and support will be needed for products that are less expensive.

The position of selected leading hardware vendors on UNIX is outlined in Exhibit V-3 and described below.

EXHIBIT V-3

Selected Hardware Vendors' UNIX Directions

DEC	UNIX and VMS equal Ultrix and OSF/1 Kernel NAS umbrella Interoperability between UNIX, VMS and other vendors' systems "Open" VMS Revamping complete product line to RISC architecture Added value above operating system; CASE
HP	HP-UX and MPE separate but equal HP-UX and OSF/1 kernel NetWave Computing umbrella Interoperability between UNIX, MPE and other vendors' systems First out with midrange RISC platform Broadening software products base; CASE
IBM	UNIX as an alternative AIX and OSF/1 kernel SAA umbrella Interoperability between UNIX and SAA
NCR	All UNIX UNIX system V.4 standard OCCA Umbrella New X486 hardware and massively parallel machines OLTP emphasis
Unisys	UNIX and proprietary equal IIE umbrella Interoperability between UNIX and other vendors' systems Vertical specialization and OLTP

Note that these are directional statements only, and vendor strategies are in various stages of implementation. Hewlett-Packard, the largest UNIX supplier, and NCR are the farthest along. Although there is variety in approach, the central theme is “open systems”, UNIX being one element of the integrated whole. What also stands out is that vendors are beginning to realize, and capitalize on, the inevitability of UNIX standards.

a. Digital Equipment Corp.

Although it initially straddled the fence, DEC has recently revealed a strategy that makes UNIX of equal importance to VMS over the long term. DEC's version of UNIX—Ultrix—has been even less portable than most, since it has many DEC enhancements. Now, however, DEC has indicated that it will integrate the OSF/1 operating kernel into Ultrix.

- DEC was the first company to have a POSIX-compliant UNIX operating system. And VMS will be compliant with POSIX. It will also meet standards and requirements for X/Open certification. With this move, VMS will meet existing portability and interoperability standards, providing many of the user benefits found in UNIX but without being vendor independent. It thus makes VMS more acceptable; developers can write applications to run on VMS and then on Ultrix with only minor revisions.
- DEC's overall theme is distributed systems. The company's goal is to have one operating system kernel for all platforms—from the desktop to the data center. Just as IBM's SAA unites various IBM operating environments, DEC's Network Application Support (NAS) will be the “umbrella” providing distributed computing capability and eventual interoperability between DEC VMS, Ultrix, and OSF/1-based Ultrix. It will also eventually provide interoperability between DEC systems and other vendors' systems, including MS-DOS and OS/2.
- To differentiate, DEC will emphasize value-added features above the operating system level. It has announced Fuse—an integrated group of back-end CASE tools for programmers to use in debugging, coding and testing. DEC's long-term strategy includes continued development of multimedia technology designed into a distributed computing environment.
- DEC currently has no plans to move its popular Rdb relational data base to Ultrix; however, Ultrix users will be able to access Rdb running on VMS.
- DEC has a popular RISC workstation product line and several months ago announced a -486 machine. DEC has recently announced a replacement for its 11-year-old VAX product line, to be completed in two years. Thus, DEC is redesigning its entire VAX architecture and

VMS operating system—a challenging and expensive undertaking. The new computers will range from workstations to mainframes and all will use RISC. The customer will have a choice of operating system—VMS or UNIX—for the new RISC product line.

b. Hewlett-Packard

HP's dominant operating system is its proprietary MPE; nonetheless, revenues from its multiuser UNIX operating system grew an estimated 60% last year whereas MPE revenues only grew 10%. Strategically, HP considers MPE and UNIX equally important.

HP's UNIX involvement includes:

- A RISC product line spanning workstations, including the 9000/400 merged HP/Apollo workstation, through the 9000 midrange multiuser series. HP is expected to introduce a RISC processor that is more than twice as fast as Motorola's 88000. HP was first among the leading computer vendors to make a significant market impact with its RISC technology.
- HP's version of UNIX is System V-based UX; HP also plans to offer the OSF/1 operating system kernel.
- HP is aggressively broadening its system and applications software products offerings through strategic partnerships. It has recently announced a partnership with Computer Associates (CA) whereby CA will develop system management products, DBMSs, and applications software products that run under HP UX. CA will first migrate its systems management tools to HP-UX with product rollouts in December of this year.
- HP has licensed its SoftBench technology to Informix as part of an integrated, flexible CASE environment that Informix will make available to other hardware and software companies for UNIX applications development. SoftBench provides a common interface to and communication among tools used to analyze, design, construct, debug, test and maintain software products.
- HP and Sun recently announced a plan to jointly develop an object-oriented software environment for distributed, multivendor computing.

c. IBM

IBM's systems and software supremacy in mainframe-based enterprise solutions is being threatened by strong market interest in downsizing, and increasingly available communications and computer technology that allows downsizing. Its position is also threatened by increasing competition from midrange vendors who are experiencing declining markets for their hardware; IBM is starting to respond to the threat.

IBM is now positioning itself as the industry's "leading open systems vendor"—but in reality its open systems operate only within the IBM family of products. Its primary thrust into integrated computing is through SAA, first described by IBM in March 1987.

The migration to SAA is slow, due in large part to lack of product availability. However, IBM is expected to announce an OS/2 version of its Advanced Peer-to-Peer Networking platform next month whereby users will have transparent access to all of IBM's SAA computing resources across a multinode network.

SAA's original objective was to unite OS/2EE, OS/400, VM and MVS environments. Although the timing is unclear, these environments will eventually interoperate with AIX.

In addition to providing interoperability between SAA and AIX, IBM's future direction is to incorporate the OSF UNIX operating kernel into AIX. Incorporation of the OSF kernel is a significant step for IBM and for the UNIX marketplace as a whole. It clearly signals a strong vendor movement to address user demands for standards—a move against the longstanding IBM (and other vendors') strategy of customer "lock-in."

Strategic issues for IBM include:

- Whether it can implement enough pieces of SAA fast enough so that UNIX remains a secondary alternative rather than of equal importance to SAA.
- What to do about declining interest and market confusion over OS/2. IBM has positioned OS/2 as a core platform for implementing SAA, yet users favor the easier-to-use Windows, introduced last year, and DOS. If OS/2's position fails to improve, IBM may be forced to speed up its UNIX activities and AIX's integration with SAA, perhaps positioning its well-accepted RISC workstations as the desktop of choice for an integrated solution.

AIX currently runs on IBM's RISC System/6000 workstations, OS/2, -386 and -486, the RT system and the ES/3090. Introduced in early 1990, RISC workstations were quite successful, and 25,000 of them (worth \$1 billion) were sold during the last six months of 1990.

IBM is beginning to establish porting centers worldwide to assist software developers in moving their applications to the RISC System/6000 family, and it is developing AIX/RISC CASE products in conjunction with IBM business partners.

d. NCR

NCR is the only one of the original "BUNCH" vendors that is migrating all of its products to UNIX. In the fall of 1990 it became the first major computer vendor to make a unilateral commitment to UNIX when it announced a complete line of hardware based on the Intel X86 architecture. The company is developing software based on a blueprint called Open Cooperative Computing Architecture (OCCA) and is billing itself as the first company to offer OSI products from the desktop to the mainframe. OCCA encompasses MS-DOS, OS/2 and UNIX operating systems.

- NCR will provide an end-to-end enterprise solution using UNIX System V.4. Another key difference in NCR's strategy compared to its traditional competition is its partnership with Terradata to bring UNIX to massively parallel machines with 100,000 MIPS as a commercial general-purpose computer system.
- The System 3000 line is a scalable computer family ranging from laptops to mainframes, all based on Intel X86 microprocessors with IBM's Microchannel architecture.
- NCR's forte is OLTP and it has a strong presence in the banking and retail distribution sectors. NCR's Top End, a commercial UNIX OLTP software system designed for its new System 3000 midrange line, is integrated with Oracle, Sybase and Informix data bases and will ship in June 1991.
- NCR Cooperation is a common development environment that runs UNIX V.4 and OS/2 and incorporates OSF/Motif. It includes an object framework library, which makes it possible to encapsulate old applications as objects that can coexist with other, more recent applications within a system. This allows users to move from an older NCR platform—or anyone else's—to System 3000 without having to rewrite every line of code.
- Open Network Environment is a network architecture that is consistent with Open Systems Interconnection (OSI) protocols in all seven layers.

The key to NCR's success now is execution, as all of the pieces of its plan are in place.

e. Unisys

Unisys is strongly and deliberately using UNIX as one of its "weapons." The nation's third largest computer firm was among the first (in October 1990) to announce a plan to mix open, proprietary and de facto standards to unite Unisys' and other vendors' systems. Unisys, like its competitors,

IBM is now positioning itself as the industry's "leading open systems vendor"—but in reality its open systems operate only within the IBM family of products. Its primary thrust into integrated computing is through SAA, first described by IBM in March 1987.

The migration to SAA is slow, due in large part to lack of product availability. However, IBM is expected to announce an OS/2 version of its Advanced Peer-to-Peer Networking platform next month whereby users will have transparent access to all of IBM's SAA computing resources across a multinode network.

SAA's original objective was to unite OS/2EE, OS/400, VM and MVS environments. Although the timing is unclear, these environments will eventually interoperate with AIX.

In addition to providing interoperability between SAA and AIX, IBM's future direction is to incorporate the OSF UNIX operating kernel into AIX. Incorporation of the OSF kernel is a significant step for IBM and for the UNIX marketplace as a whole. It clearly signals a strong vendor movement to address user demands for standards—a move against the longstanding IBM (and other vendors') strategy of customer "lock-in."

Strategic issues for IBM include:

- Whether it can implement enough pieces of SAA fast enough so that UNIX remains a secondary alternative rather than of equal importance to SAA.
- What to do about declining interest and market confusion over OS/2. IBM has positioned OS/2 as a core platform for implementing SAA, yet users favor the easier-to-use Windows, introduced last year, and DOS. If OS/2's position fails to improve, IBM may be forced to speed up its UNIX activities and AIX's integration with SAA, perhaps positioning its well-accepted RISC workstations as the desktop of choice for an integrated solution.

AIX currently runs on IBM's RISC System/6000 workstations, OS/2, -386 and -486, the RT system and the ES/3090. Introduced in early 1990, RISC workstations were quite successful, and 25,000 of them (worth \$1 billion) were sold during the last six months of 1990.

IBM is beginning to establish porting centers worldwide to assist software developers in moving their applications to the RISC System/6000 family, and it is developing AIX/RISC CASE products in conjunction with IBM business partners.

d. NCR

NCR is the only one of the original "BUNCH" vendors that is migrating all of its products to UNIX. In the fall of 1990 it became the first major computer vendor to make a unilateral commitment to UNIX when it announced a complete line of hardware based on the Intel X86 architecture. The company is developing software based on a blueprint called Open Cooperative Computing Architecture (OCCA) and is billing itself as the first company to offer OSI products from the desktop to the mainframe. OCCA encompasses MS-DOS, OS/2 and UNIX operating systems.

- NCR will provide an end-to-end enterprise solution using UNIX System V.4. Another key difference in NCR's strategy compared to its traditional competition is its partnership with Terradata to bring UNIX to massively parallel machines with 100,000 MIPS as a commercial general-purpose computer system.
- The System 3000 line is a scalable computer family ranging from laptops to mainframes, all based on Intel X86 microprocessors with IBM's Microchannel architecture.
- NCR's forte is OLTP and it has a strong presence in the banking and retail distribution sectors. NCR's Top End, a commercial UNIX OLTP software system designed for its new System 3000 midrange line, is integrated with Oracle, Sybase and Informix data bases and will ship in June 1991.
- NCR Cooperation is a common development environment that runs UNIX V.4 and OS/2 and incorporates OSF/Motif. It includes an object framework library, which makes it possible to encapsulate old applications as objects that can coexist with other, more recent applications within a system. This allows users to move from an older NCR platform—or anyone else's—to System 3000 without having to rewrite every line of code.
- Open Network Environment is a network architecture that is consistent with Open Systems Interconnection (OSI) protocols in all seven layers.

The key to NCR's success now is execution, as all of the pieces of its plan are in place.

e. Unisys

Unisys is strongly and deliberately using UNIX as one of its "weapons." The nation's third largest computer firm was among the first (in October 1990) to announce a plan to mix open, proprietary and de facto standards to unite Unisys' and other vendors' systems. Unisys, like its competitors,

is working towards a solution that protects its proprietary systems and at the same time offers an open systems approach. Unisys may open its proprietary system, as DEC plans to do with VMS.

Other key elements of Unisys' strategy are its own software tools, notably its third-generation application programming interfaces and fourth-generation CASE offerings.

Unisys will add value through "premium services" for open systems, which will take advantage of its existing product and technology strengths and will include industrial-strength transaction systems, integrated data base recovery, and multilevel security, CASE/4GL and image/voice processing.

2. Systems Management and Application Development Tool Vendors

Although the market for UNIX systems management and design tools is highly fragmented, RDBMS companies are leading the charge. They will need to continue to form alliances with other third-party tool vendors and/or the large systems vendors in order to become providers of complete UNIX development environments.

For systems and applications software products vendors alike, the cost of supporting all the different variants and new hardware platforms is enormous and is a drain on development funds that could be spent on improving their core products. Systems software interacts closely with the operating system kernel, which may vary dramatically from vendor to vendor. Informix alone supports more than 600 variants of UNIX on more than 80 hardware platforms. Therefore it is imperative that systems and applications software vendors begin to consolidate their efforts individually and in alliance; the movement towards standards will help.

Product issues and market needs being addressed by system management and tool vendors as they begin to provide UNIX products are outlined in Exhibit V-4 and include:

- Network reporting and management products on the market today are functionally limited to networks in the 200-300 node range, which is one reason users are not adopting UNIX en masse for enterprisewide solutions.
- Tools do not exist that can tune a network that consists of UNIX-based machines from different vendors.
- How to maintain consistency of data across a widely distributed network without having a main backbone network in place is a challenge.
- Few if any configuration management tools exist.

- Performance monitoring and capacity management tools do not exist for UNIX.
- OLTP monitors do not exist.
- CASE for UNIX consists of a confusing set of utilities that don't interface well with each other.
- A broad suite of application developments tools for UNIX is available, especially windowing environments and RDBMS tools. An environment that integrates them with non-UNIX design tools is needed.
- With so many variants of UNIX and C, the marketplace is confused about what implementation of C the tools run on and the actual version of C that the tool produces.
- Standards bodies need to design a set of tools that have a common look and feel and would provide a programmers' library.
- Security needs to be improved for networked UNIX.

EXHIBIT V-4

**UNIX System Management
and Development Tools
Product Issues/Market Needs**

- Network reporting and management
- Tools to "tune" networks and maintain data consistency across a distributed network
- Configuration management tools
- Performance monitoring and capacity management
- Integrated CASE environments
- Improved security .

Technical users or individual workstation users do not need much in the way of systems and network management tools, but when UNIX systems become data base servers in corporate networks or platforms for mission-critical systems, these tools become critically important. When standards are fully implemented by vendors, systems software companies will be offered a broader market and we may expect to see more tools of the kind usually seen on MVS and VMS.

Involvement in UNIX and the UNIX activities of several leading systems software vendors are outlined in Exhibit V-5 and in the text below. RDBMS companies have been experiencing declining or negative profitability and are looking to growth in areas—UNIX tools included—outside their original RDBMS business. It is interesting to note how each one is approaching integration of UNIX tools with non-UNIX tools.

EXHIBIT V-5

Systems Software Vendors' UNIX Activities

Informix	Major thrust is UNIX OpenCase through SoftBench framework
Oracle	GUIs, networking, CASE, applications software products
DEC	Cohesion applications development environment Fuse integrated CASE
Microsoft	XENIX development OS/2 version 3 with New Technology, RISC
IBM	AIX/RISC CASE products
TI	Multiplatform capabilities of IEF

- Informix—the first company with a commercial RDBMS for UNIX in 1981. This lead gives Informix the largest installed base of RDBMS applications for UNIX. Its RDBMS products include:
 - Informix OnLine, a mainframe replacement data base engine with on-line transaction processing/multimedia capabilities.
 - Informix SE—an SQL data base engine targeted at smaller MIS organizations that require light transaction processing for decision support applications.

Informix's fundamental focus has always been UNIX, first with RDBMS products, 4GL, and then an OLTP data base server for UNIX.

Informix is positioning itself as a catalyst for pulling together design tools. It will provide a UNIX CASE environment through the overall framework of Hewlett-Packard's SoftBench tool kit that will manage the

entire life cycle of large-scale UNIX and DOS-based applications. As part of the HP-Informix alliance, HP will acquire up to 10% of Informix common stock.

The suite of products will include the character-based Informix/4GL as well as third-party CASE products, plus a wide range of CASE tools already compatible with SoftBench.

Informix's own application development tools to support the OpenCase environment include OpenCase/SSADM, an analysis and design workbench, and 4GL programming languages. OpenCase is scheduled to be shipped in late 1991 and is supported by AT&T and Sun.

- Oracle Systems Corp.—UNIX has become Oracle's largest revenue generator. For the first two quarters of fiscal 1991, UNIX accounted for 48% of worldwide revenues, up from 35% in fiscal 1990 and 27% in fiscal 1989. Oracle's development efforts are focused on GUIs, networking, CASE, and applications software products with less emphasis on RDBMS.

In January, Oracle introduced Oracle RDBMS Version 6.0 on AT&T platforms running UNIX System V.4. It also introduced versions of its SQL*Forms and SQL*Menu for the OSF/Motif user environment. Users can run their existing character-based applications on the OSF/Motif environment transparently. Additionally, developers can develop applications on either character-mode or bit-mapped computers without having to reprogram or recompile the application.

- DEC is addressing a key market need by offering a variety of associated development tools under one umbrella—its Cohesion application development environment. DEC's Fuse is an integrated group of back-end CASE tools for programmers to use in debugging, coding and testing. The product runs on DEC RISC platforms under Ultrix.
- Microsoft is integrating PCs into the UNIX world in the following ways:
 - It developed XENIX and owns almost 20% of SCO.
 - Windows 3.0 has received recognition as a client interface in a UNIX server environment; the company plans to move Windows into a 32-bit environment.
 - OS/2 Version 3 will offer DOS, Windows, POSIX and OS/2 application program interface compatibility. At the ground level of Version 3 is a component called New Technology (NT), a proprietary yet UNIX-like kernel.

- A coalition has recently been formed by Microsoft, DEC, Compaq, Mips Computer Systems and SCO to help move Windows and Microsoft's forthcoming NT operating system into the RISC market.
- IBM is developing AIX/RISC CASE products in conjunction with IBM business partners.
- Texas Instruments has added multiplatform capabilities to its Information Engineering Facility (IEF) CASE software which will allow users to build applications using C that are executable under IBM's MVS, VM and OS/2, DEC's VMS, and several versions of UNIX.

3. Applications Software Products Vendors

Most of the UNIX applications software products available today are either from PC vendors porting their products to UNIX platforms or UNIX vendors offering PC-like products for UNIX platforms. Although thousands of UNIX software packages are available, ranging from accounting and time management to spreadsheets and word processing, much of it is the same character-based functionality that a user gets on a PC, though on a more expensive hardware platform.

Applications software products are needed to take advantage of UNIX's networking and application-linking functionality. Production-level applications software products require a data base strategy, communications capability, and hierarchical storage technology, among other things. This means that vendors who successfully offer production level applications need to be technically broad-based.

Although integrators and in-house programming organizations have undertaken relatively sophisticated UNIX development, little of the innovation has appeared yet as commercial prepackaged applications software products. Companies like Lawson Associates and Ross Systems are leading the way.

Transitional issues, appearing as applications software products vendors begin to develop more sophisticated UNIX products, are outlined in Exhibit V-6, and include:

- Trying to protect license revenue from existing applications software products based on proprietary operating systems is a critical issue. UNIX applications software products that are on the drawing boards are not talked about because of concern over erosion rate and loss of existing installed base.
- Application development tool standards and integrated environments do not exist for UNIX. Lack of standards causes confusion.

Due to the confusion, applications software vendors, such as Lawson Associates, are falling back upon themselves and developing their own tool environments. Systems vendors in particular are beginning to offer integrated programming environments, such as NCR's Cooperation and DEC's Fuse.

- Inexpensively providing portability across multiple machines and multiple operating systems is another key issue. A number of applications software products vendors are developing their own tools. Vendors are most concerned about transportability, not specifically UNIX.
- To succeed, midrange and mainframe-based applications software vendors will need to reorient their product marketing and sales efforts to reflect the realities of lower priced applications software products.

EXHIBIT V-6**Applications Software Products Vendors'
UNIX Opportunities/Challenges**

- Protecting existing licensing revenue
- Providing portability inexpensively
- Lack of development tool standards and integrated environments
- Reorienting marketing and sales efforts

Distribution channels will either have to add value, such as systems integration or vertical sector expertise, or be very low cost. New distribution technologies such as CD ROM will come into play. Thus, companies with already existing strong alliances, third parties—including VARs—and systems integrators will be in better position to prosper with UNIX.

Software vendors will be more motivated to write applications software when the market pull is stronger and when they do not have to rewrite from vendor to vendor.

Exhibit V-7 and the following brief profiles give examples of how applications software products companies are positioning themselves. They logically take direction from the systems vendors upon whose products their current/proprietary products are based.

EXHIBIT V-7

Application Software Products Vendors' UNIX Posture

Computer Associates	CA90s framework for integration Interoperability of multiple UNIX versions, proprietary systems, multivendor platforms
Santa Cruz Operation	XENIX for PCs Retail distribution Open Desktop integrates DOS, XENIX, System V.4
Lawson Associates	All products ported to UNIX Major investment to provide portable UNIX alternative
Ross Systems	Porting products to DEC's Ultrix

a. Computer Associates

CA90s, introduced last year as the technical foundation for Computer Associates' "Enterprise Software Solutions", will continue to be the underpinning upon which Computer Associates integrates its software product offerings. UNIX will operate within the CA90s foundation: CA90s will provide service layers for UNIX-based products as well as other operating systems-based products.

CA made known its UNIX position and direction in January; it provides a clear example of vendor intention to provide interoperability rather than UNIX *per se*. CA will provide applications software products across homogeneous and heterogeneous networks, identical UNIX systems, and UNIX systems from multiple vendors. Most CA products will address the UNIX platforms of the major vendors, including those of AT&T, Bull, Digital, HP, IBM, NCR, Olivetti, The Santa Cruz Operation, Siemens/Nixdorf, Sun and Unisys.

UNIX-based products will be integrated closely with all other CA offerings across IBM mainframes, DEC VAX/VMS systems, PCs and other platforms. Actual implementation of this large an undertaking is at least several years away.

CA has recently joined UNIX International and OSF. Its first steps in UNIX are to release RDBMS products running on the HP-UX platform, which are in beta testing. It has recently reached an agreement with Hewlett-Packard for joint development and marketing of system management tools based on HP-UX. The first system administration tools are due in early 1992. CA will resell HP's multiuser RISC platform for UX.

b. The Santa Cruz Operation (SCO)

SCO, founded in 1979 and privately held, has built its business by offering a version of UNIX for the Intel Corp. platform. This company's product line exemplifies the blurring distinctions between PCs and workstations.

In 1981, SCO began working with Microsoft to develop and market XENIX, the first commercial version of the UNIX operating system. It is an enhanced version of AT&T's UNIX System V.

SCO is also a leading supplier of UNIX applications software. It has over 3,000 applications software products ported to XENIX. SCO is the only UNIX vendor with significant retail presence.

SCO's Open Desktop is a graphical operating system that can:

- Run DOS, XENIX and UNIX System V applications or Open Desktop applications
- Run multiple applications in separate windows simultaneously
- Use Open Desktop programming tools to develop applications. These tools include application programming interfaces (APIs) for GUI networking, data base and DOS-UNIX integration.

Open Desktop is an interesting example of integration from both user and developer standpoints; it integrates Motif, UNIX, networks, applications and RDBMSs through a single graphical user interface. Open Desktop uses Ingres/386 RDBMS and SCO ISAM, which provides a library of C-language functions for creating and manipulating indexed file systems. It also includes interface specifications and libraries to other major networked relational data base systems such as Oracle's.

c. Other UNIX Applications Software Products Vendors

- Lawson Associates, with targeted revenues in the \$75 million-\$80 million range for 1991, sold \$1.5 million in UNIX products over the last six months. It expects that within five years, 50% of revenues will be UNIX-derived. It has had UNIX versions of its Pinstripe accounting software since March 1990. Its human resources packages are also now ported to UNIX. The products run on IBM, Unisys, DEC, HP and Sequent UNIX versions.

- **MCBA**—MCBA's Classic software consists of 18 packages for accounting, distribution and manufacturing. The first versions of the software run on DEC VAX, Wang and HP midrange computers. MCBA has had UNIX versions available for five years. The software is written in RM/Cobol 85, which allows it to run on multiple versions of UNIX with little redesign. MCBA offers software for SCO XENIX, IBM AIX, Sun OX, HP UX, Altos UNIX and the Data General Avon line. An estimated 50% of revenues is from UNIX products.
- **Oracle**—In addition to its UNIX systems software products, applications software products are Oracle Personnel and Oracle Financials. Both are distributed applications based on the Oracle RDBMS.
- **Ross Systems** is taking an aggressive UNIX position. It introduced its first UNIX applications software products in February this year. A long-time provider of accounting and financial applications for DEC's VAX/VMS systems, Ross will focus its UNIX efforts on DEC's Ultrix version of the UNIX operating system.

The first applications in the Ross Renaissance Open Series include General Ledger, Accounts Payable and Inventory Control. They are slated for availability in June. Ross' move into UNIX tackles one portion of a comprehensive technology plan, which also includes implementing client/server computing, relational data base technology and DEC's Network Application Support services.

4. Niche Players

Because of all the product opportunities, some of which were described above, dozens if not hundreds of small companies are entering the market. Several examples of the diverse products and the opportunities they offer are briefly mentioned below.

- **Cleo Communications**—software that allows UNIX workstation users to interact with IBM 3270 mainframes at high data transfer rates.
- **JSB Computer Systems**—a window manager for dumb terminals that mimics the look and feel of OSF/Motif.
- **Locus Computing**—A PC interface for Macintosh that allows Macintosh users to share application, file and print services when connected to UNIX hosts.
- **TGV**—X/View toolkit that allows Windows-based applications written for Sun Microsystems workstations to be ported to DEC's VAX VMS platform.
- **Tyan Computers**—a 486-based workstation that runs DOS as a task under UNIX.

- Visix—Looking Glass desktop manager provides a set of icons for UNIX file types.

C

Support and Distribution

The support and distribution infrastructure for UNIX is undeveloped. Large systems integrators are not emphasizing UNIX; small specialty systems integrators are cropping up to take advantage of the void. Likewise, other distribution channels are, for the most part, not yet conversant in UNIX nor convinced they want to take it on.

1. Professional Services and Systems Integrators

Systems integrators are providers of solutions rather than a specific technology or UNIX; they do not go out of their way to "sell" UNIX. These companies are just getting started in UNIX.

- Andersen Consulting's New Age Systems Group, founded six years ago, is a group of 60 people that spearheads new technology. Its emphasis is distributed computing, not specifically UNIX. Last year 50% of this group's chargeable hours were UNIX-related and 50% were OS/2-related. The group's revenue split expectation for this year is 75% UNIX-related and 25% OS/2-related.
- Computer Task Group does not consider UNIX a major influence on its strategy; an estimated 10% of its business is UNIX-related. It does, however, believe that future growing momentum behind AIX will be a clear influence on its business.
- EDS, as an integrator of customized solutions for specific industries and traditionally IBM in its orientation, sees UNIX as a component of the overall solution. EDS's position on UNIX is that it encourages the continued development of standards and more-robust UNIX products.

Third-party systems integrators, or the internal systems integration organizations of systems vendors, will eventually be a key way to sell UNIX to Fortune 500 companies. The reason is that one of the biggest barriers to moving to open systems is that users don't know how to make such a move. UNIX systems integration and custom consulting will be big business as users grapple with issues such as the following:

- Implementation of enterprise solutions and standards
- UNIX networking design/implementation
- UNIX networking management
- Testing and porting
- Maintenance services

Vendors are beginning to respond to these needs. Hardware vendors, such as Pyramid Technology, are developing new professional services organizations. Large systems integrators, however, who are doing a good business in proprietary-to-proprietary integration have not found a large market opportunity yet in UNIX.

2. Distribution

At present, the major UNIX sales thrust is direct. OEMs are another active channel. SCO is the only UNIX company with any retail presence.

Eventually, UNIX will be sold at all levels. However, some of the challenges facing UNIX distribution channels that prevent this from happening in the short term are listed in Exhibit V-8.

EXHIBIT V-8

UNIX Distribution Channel Challenges

- UNIX must be interoperable and multivendor to gain the support of existing distribution channels
- UNIX needs to be explained and sold as a solution rather than another technology
- UNIX operating systems' strong points must be emphasized while battling the perception of complexity
- Commitment needs to be made to value-added solutions
- Applications software products must be made more widely available

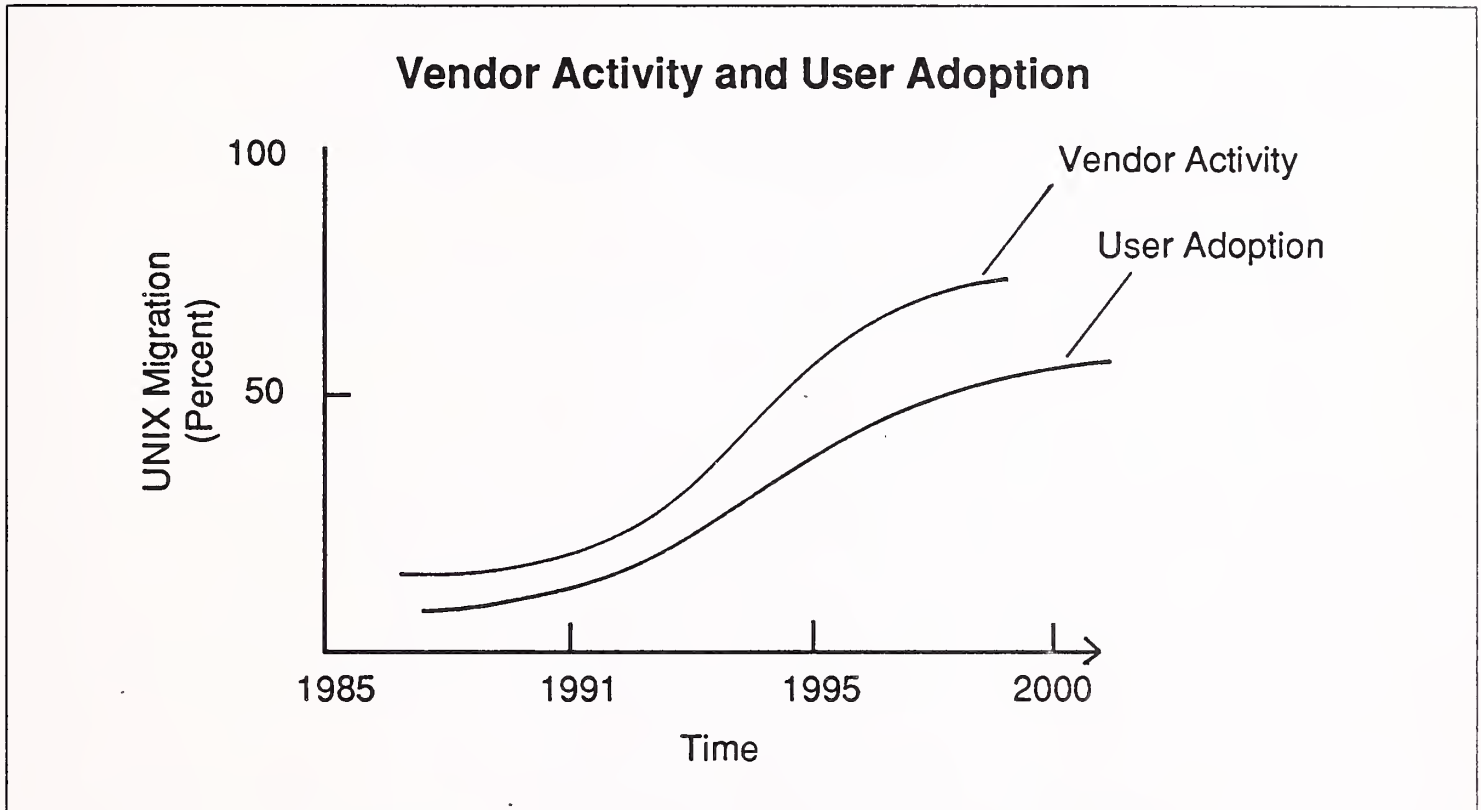
D

Conclusions about Vendors

All of the components necessary to make UNIX a viable operating system in the commercial arena are not fully formed. However, a level of vendor commitment and planning is present that did not exist even one year ago. Large systems and software vendors are adding to the momentum. Notable examples include IBM's success with its RISC workstation and NCR's total move to a standard UNIX platform. Large professional services firms will follow.

As Exhibit V-9 shows, however, user acceptance will drag behind vendor activity. UNIX will remain a difficult selling environment over the next several years. Nonetheless, as the traditional vendors commit to open systems, larger numbers of users eventually will follow.

EXHIBIT V-9



Vendor migration to UNIX and open systems is a tremendously costly undertaking and only the very large vendors can sustain both proprietary and "open" strategies. UNIX directions have been announced and strategies are in place. How effectively and quickly each vendor implements its strategies remains to be seen.

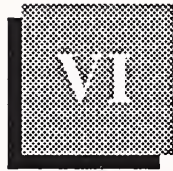
Many transitional issues are surfacing. To protect their proprietary installed base, vendors are beginning to add "openness" by meeting POSIX standards and X/Open certification requirements.

Although the UNIX evolution poses large challenges for vendors, many exciting opportunities exist. Value and differentiation will be added through service and software and through enhancing hardware technology. UNIX represents a tremendous opportunity for systems and software companies to leverage their R&D dollars and to bring out new and better technologies.



Market Forecast





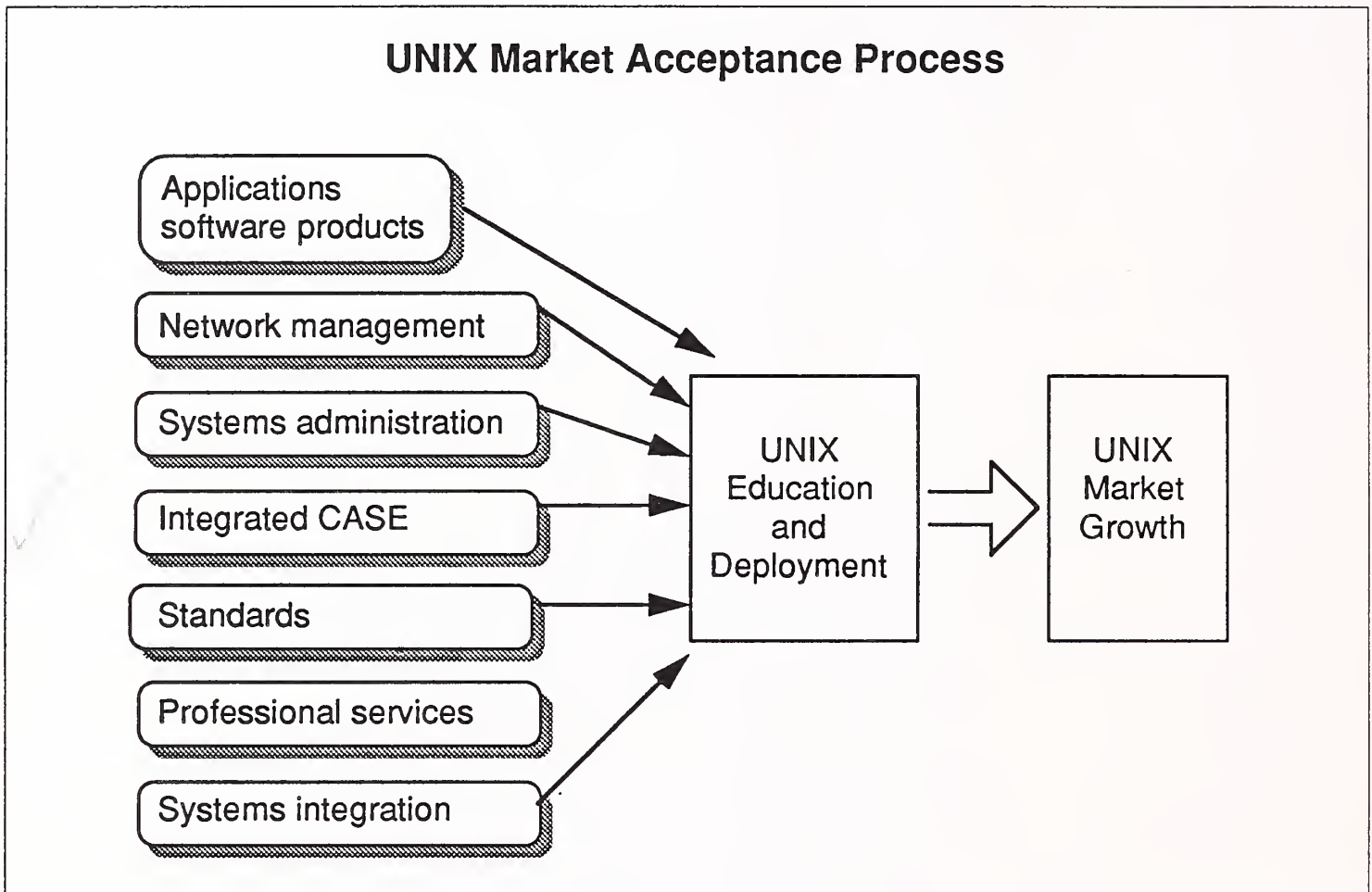
Market Forecast

The stage has been set for UNIX growth. The core technologies are available including multitasking user-interface facilities; client-server architectures; RDBMSs programmed in 4GLs; high-performance workstations; client-server architectures; OSI, TCP/IP and X series; and other network interface protocols and related standards.

During the 1991 to 1996 time frame UNIX growth will be fueled by increasing UNIX product availability—first systems control products, then applications development tools, and last to appear en masse, operations management products that utilize these core technologies. As applications software products become more varied and widely available, and as interoperability issues are resolved, users will continue their, albeit gradual, embrace of UNIX. This market acceptance process is illustrated in Exhibit VI-1.

INPUT survey findings earlier this year confirmed that the lack of a perceived business need is the largest inhibitor to new information technology implementation, representing 41% of respondent votes. Simple resistance to change, and investment in existing systems—which is related to the concern for integration of new technologies with existing systems—are also among the key concerns of IS operations.

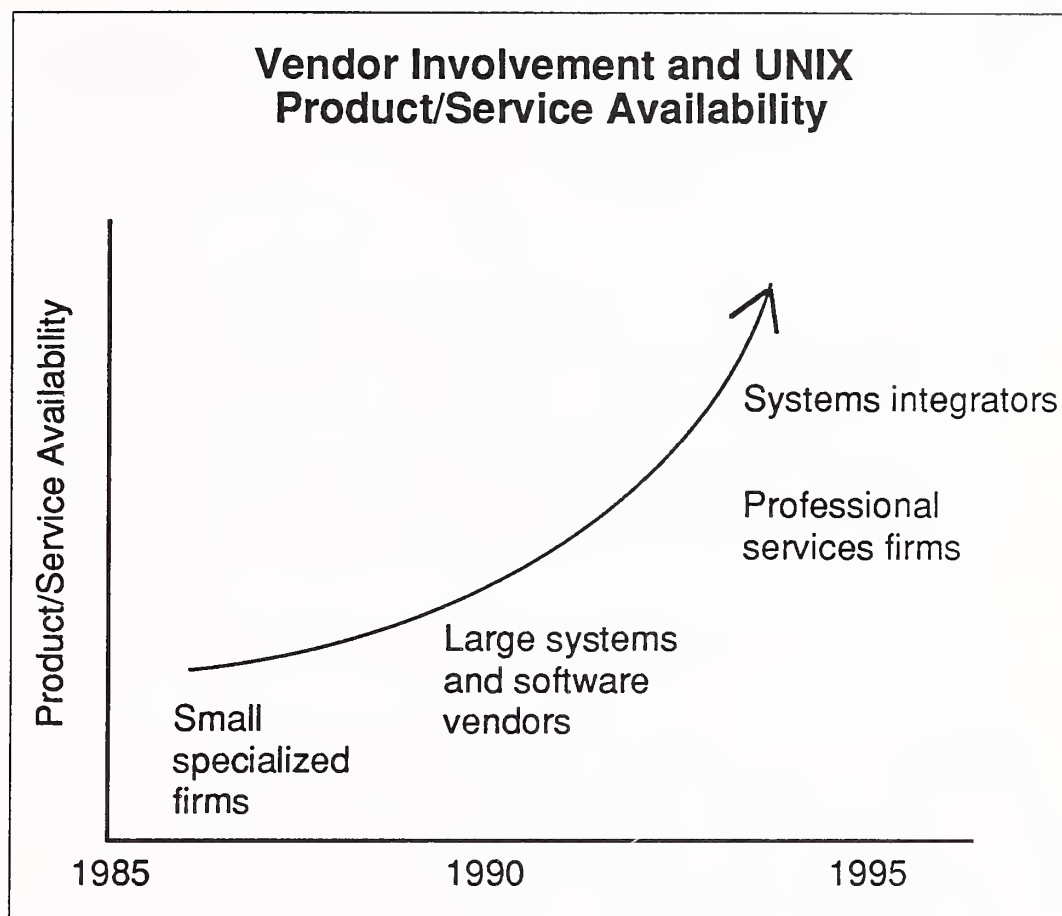
EXHIBIT VI-1



As Exhibit VI-2 shows, vendor involvement is much stronger now than during the 1985-1990 time frame, when only the relatively small workstation vendors were selling UNIX-based products; now all large systems vendors are beginning to show strong interest in UNIX. As vendors continue to strengthen their endorsement of UNIX and product rollouts snowball, end-user awareness of and knowledge about UNIX will follow. But this will take time.

In order to put UNIX into its proper perspective, the overall systems software forecast is presented in Section A, followed by UNIX's share of the systems software market. Section B provides INPUT's five-year forecasts for UNIX operating systems by platform size. UNIX driving forces are discussed in Section C; a brief look at the European market is given in Section D; and, lastly, Section E discusses the impact of UNIX on other information services delivery modes.

EXHIBIT VI-2

**A****Systems Software
Forecast****1. Systems Software Expenditures by Product Category**

To set the stage for a UNIX forecast, Exhibit VI-3 shows systems software expenditures by major category—systems control, applications development tools and operations management—for 1991 and 1996.

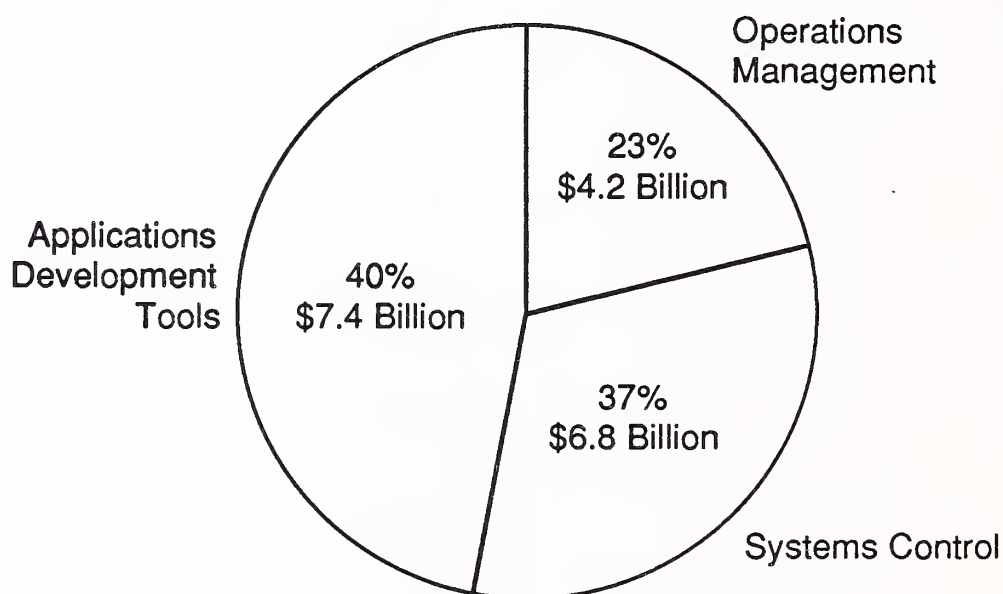
Systems control products are supervisory programs that provide automatic management and allocation of systems network resources during the execution of application programs. These products include operating systems, emulators, network control products such as NetView and NetMaster, library control, access control, and spoolers.

Because hardware unit shipments are no longer experiencing the explosive growth of several years ago, this is no longer a strong growth promoter. However, new systems control products, including network integration products and products that support standards—running on both new and existing hardware—will fuel the market.

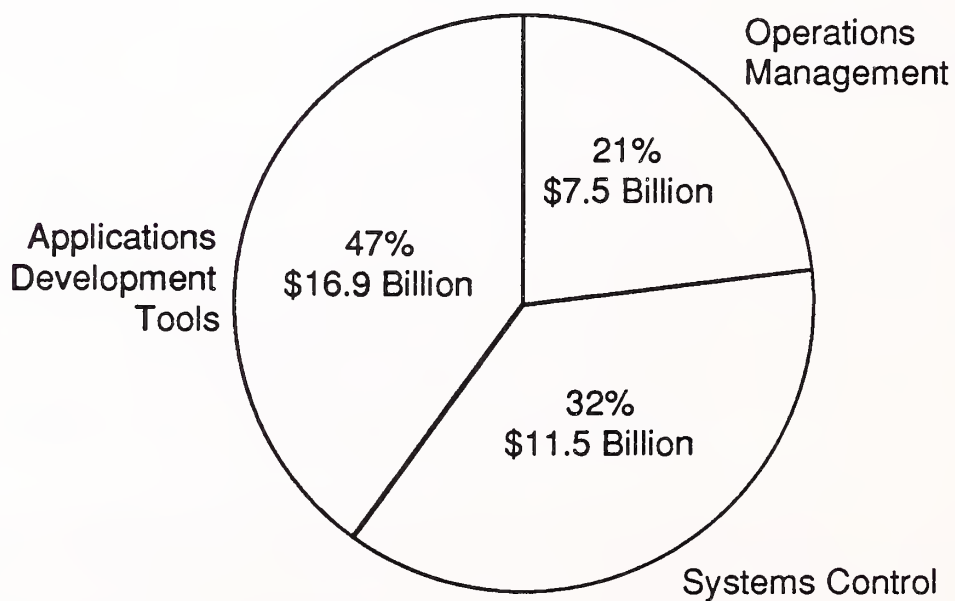
EXHIBIT VI-3

**Systems Software Market by
Major Product Category**

1991 - \$18.4 Billion



1996 - \$35.9 Billion



Applications development tools include traditional programming languages, 4GLs, data dictionaries, data base systems, and other development productivity aids. Applications development tools will grow as a percent of the total (40% to 47%), fueled by the need to improve software development productivity and by the continuing shortage of software engineers.

The operations management tool market, the smallest of the three systems software submodes, includes performance monitoring and system administration products. Growth drivers for operations management tools include the fact that the complexity of the data center environment is continuing to increase rapidly. Also, the increasing requirement for integration and the advent of standard architecture models fuel demand for data center management programs for LAN and inter-LAN-based monitoring and control.

2. UNIX's Share of Systems Software Expenditures

UNIX is moving slower than forecasted in INPUT's 1989 report, *U.S. Market for UNIX, 1989-1994*. In 1989, INPUT forecasted that UNIX would account for 31% of the overall systems software market by 1994. INPUT has adjusted its forecast downward to only 10% penetration of the systems software market by 1994. Although UNIX has been around since the late 1960s, in terms of product evolution and readiness for the commercial market, it is still in its infancy.

UNIX products will play a role in all three systems software product categories, as shown in Exhibit VI-4. Nonetheless, by 1996 UNIX will still only account for a relatively small percentage of user expenditures on systems software. The UNIX share of the total spent on systems software in 1991 is 8%, forecast to grow to only 13% of the total by 1996. Thus, the proprietary systems business will remain healthy for some time.

Several of the reasons that UNIX will still only account for a small portion of the systems software market are:

- In its 1990 report, *U.S. Systems Software Market, 1990-1995* INPUT forecasted that mainframe systems software would account for 47% of all user expenditures on systems software by year-end 1990; by 1996, this is likely to have fallen to about 40%, still the largest sector. The vast majority of UNIX products are for minicomputers and workstations/PCs, though Amdahl is strongly pushing UNIX.

EXHIBIT VI-4

UNIX Share of Systems Software Products Market by Major Product Category, 1991 and 1996

	\$ Millions						1991-1996 CAGR	
	1991			1996				
	UNIX	Total	% UNIX	UNIX	Total	% UNIX	UNIX	Total
Systems Control	680	6,800	10	1,689	11,500	15	20	11
Application Development	600	7,400	8	1,823	16,900	11	25	18
Operations Management	215	4,100	5	1,050	7,500	15	41	13
Total	1,495	18,300	8	4,562	35,900	13	25	14

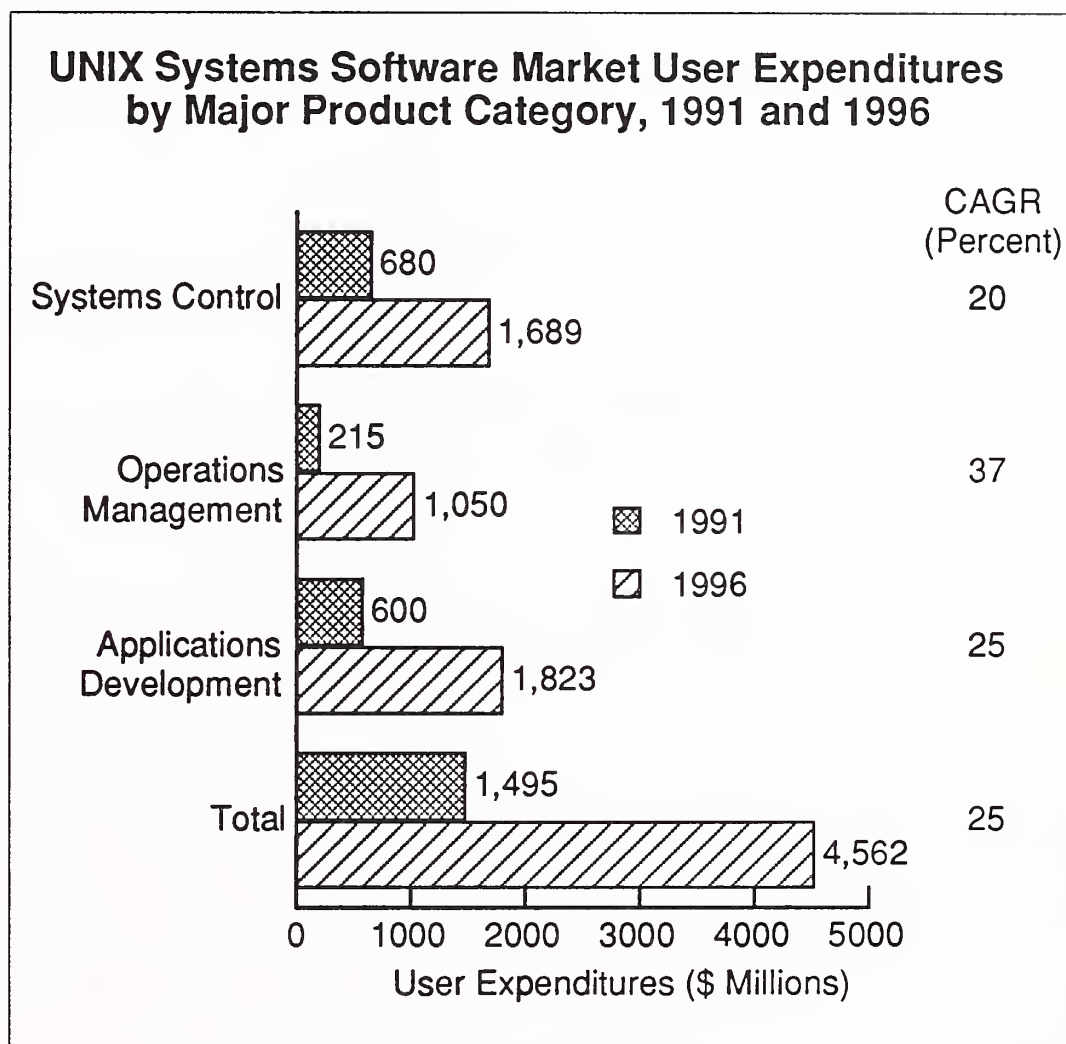
- Prices for systems software running on smaller platforms is inherently less expensive than prices for mainframe-based systems software. Competitive pressure in the UNIX market will keep prices falling as products gain in popularity and sales volumes. This will limit the growth in value of the overall UNIX systems software products market as users migrate from proprietary to open platforms. Open systems mean open competition and price performance, which favors the end-user community.

3. UNIX User Expenditure Forecast

Even though UNIX's share of the total systems software market will remain relatively small, the U.S. market for UNIX-related systems software is growing almost twice as fast as the systems software market as a whole. Exhibit VI-5 shows that the U.S. market for UNIX systems software is forecast to reach \$4.6 billion by 1996. The compound annual growth rate (CAGR) of 25% compares with a forecast of only a 14% CAGR for the whole systems software market. The market for UNIX-based applications software products is not quantified in this report, but can be expected to grow at around 35%-40% per year.

UNIX systems control products, the largest submode in 1991, will be surpassed by slightly faster growth for UNIX-based applications development tools. The predominant UNIX systems control product is operating systems, and very little exists at this point in the way of UNIX-based network control or other supervisory programs. Operations management products are just barely beginning to appear, as indicated earlier in this report. Applications development products for UNIX will continue to show strong growth as vendors continue to enter the market with products ranging from RDBMS tools to integrated CASE. As applications development is considered a success area for UNIX, this submode will flourish.

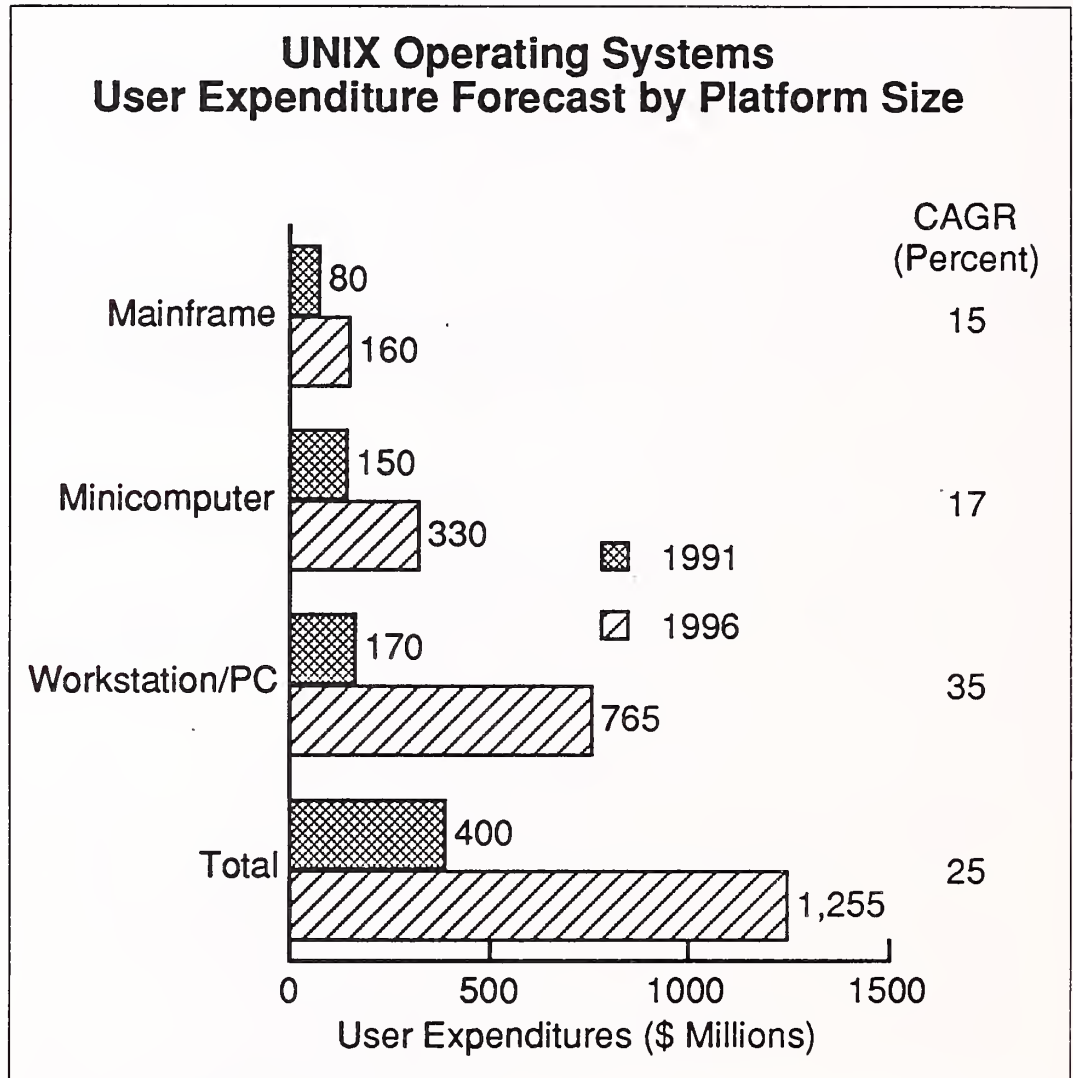
EXHIBIT VI-5

**B****UNIX Operating
System Forecast**

INPUT estimates that expenditures on UNIX operating systems account for 60% of systems control expenditures, or \$400 million in 1991. The UNIX operating system is being used across all categories of hardware platform, from mainframes and supercomputers down to PCs, as Exhibit VI-6 shows, albeit to a lesser degree in mainframes. Historically, UNIX was minicomputer-based; now, however, it is better known as an operat-

ing system for workstations. UNIX systems software products are likely to stay largely confined to the minicomputer and workstation/PC sectors. Mainframes will play the role of enterprise-wide servers, accessible by UNIX-based workstations, with or without a UNIX operating system themselves.

EXHIBIT VI-6



Although expenditure on minicomputer-based UNIX operating systems is forecast to grow at a 17% CAGR, the minicomputer sector will diminish as a percentage of total UNIX operating system expenditures. Minicomputers will act as intermediate data base servers for local workgroups. They will house transitory data or, in the future, data for specialized needs such as imaging, audio and video.

Workstations have been highly successful among professionals in the engineering disciplines—design, analysis, manufacturing, software development, energy, etc. Now, as hardware costs fall, they are beginning to be used for commercial applications such as financial control systems, accounting, and human resources. High-performance networked PCs and RISC-based workstations with a UNIX-based operating system are now competing with similar prices.

UNIX operating systems user expenditure of \$400 million in 1991 is less than one would expect, judging by the penetration of UNIX hardware. This is because UNIX pricing is lower due to the more open competitive environment, a factor which is expected to continue to push prices down compared to proprietary system software.

Expenditures on workstations drive expenditures on UNIX operating systems. Workstation revenue growth was down to around 20% in 1990, compared to 40% growth during the previous year. This downturn is attributable to the slowing of the U.S. economy, the transition from proprietary product lines to open systems, the maturing of traditional technical markets, and the lengthening of sales cycles. Intense price competition also contributed to the market's slow growth. As more general productivity and business applications become available and as product transitions are resolved, workstation market growth will accelerate back to a 25%-35% growth rate during the 1991-1996 time frame.

C

Driving Forces

As a summary, Exhibit VI-7 outlines the three general considerations that are driving the UNIX systems software market in the U.S. and that were described in detail in Chapters III, IV and V of this report. They are:

- The advantages UNIX has to offer
- Vendor endorsement and product availability
- User interest in, and demand for, UNIX

1. UNIX Advantages

Lack of a single UNIX standard is not a serious growth inhibitor in the short term, but as interests shift more strongly towards interoperability, unless standards are much more evolved than they are today, market growth will be slowed.

In the long run, standards—including UNIX—will benefit users because interoperability will become more possible and an application can outlive several generations of computers—different CPUs, different vendors. The maintenance/development backlog will ultimately be relieved and a wider selection of mix-and-match hardware and software will ultimately be available to the customer.

2. Level of Vendor Endorsement and Product Availability

All large systems vendors are making a concerted move towards UNIX and adopting UNIX standard operating system kernels. However, they are not by any means giving up on their proprietary systems.

EXHIBIT VI-7

UNIX Market Drivers**1. UNIX advantages**

- Interoperability
- Portability
- Efficiency of UNIX programming environment
- Lower prices, broader product choice

2. Level of vendor endorsement and product availability

- UNIX strategies firming up
- Systems software product availability to improve
- Applications software product availability in several years
- UNIX distribution and support infrastructure not yet in place
- Adherence to standards

3. User interest in, and demand for, UNIX

- Increasing applications development complexity/backlog
- Inefficient islands of technology
- Large installed base of proprietary systems
- Normal hardware replacement process
- Unmet needs/"upsizing"
- Knowledge about UNIX

- Digital remains strongly committed to its VMS environment even though its Ultrix version of UNIX sells well on both VAX and workstation product lines. But it is taking a whole series of steps to make VMS conform to open system standards within its NAS open systems concept.
- IBM promotes SAA as its strategic envelope across incompatible proprietary architectures. Its AIX version of UNIX is strongly promoted only for technical workstation applications, though there is constant pressure for it to push it towards SAA in the long term.
- The rest of the vendors are drawn towards UNIX more strongly as a defensive move.

3. User Interest in, and Demand for, UNIX

UNIX is now frequently considered as companies prepare to retire old systems or automate previously manual tasks, or as progressive early adopter companies try new technologies. But to sustain a CAGR of 25% or higher will require more.

Over the next several years, user interest in UNIX systems software will be driven predominantly by interests in downsizing and the price/performance attractiveness of workstations compared to larger mainframe and minicomputer systems. It will also be driven by the desire to improve applications development efficiency, which is currently considered the most successful area of UNIX. By 1994 and beyond, interest will shift more strongly to interoperability and integration. Enough large successes will have surfaced to spur market interest.

Nonetheless, mass migration will take time due to the complex challenges involved. Existing investments in working practices, data, skilled users, IS staff, software, etc., are the largest barrier to change in the user community.

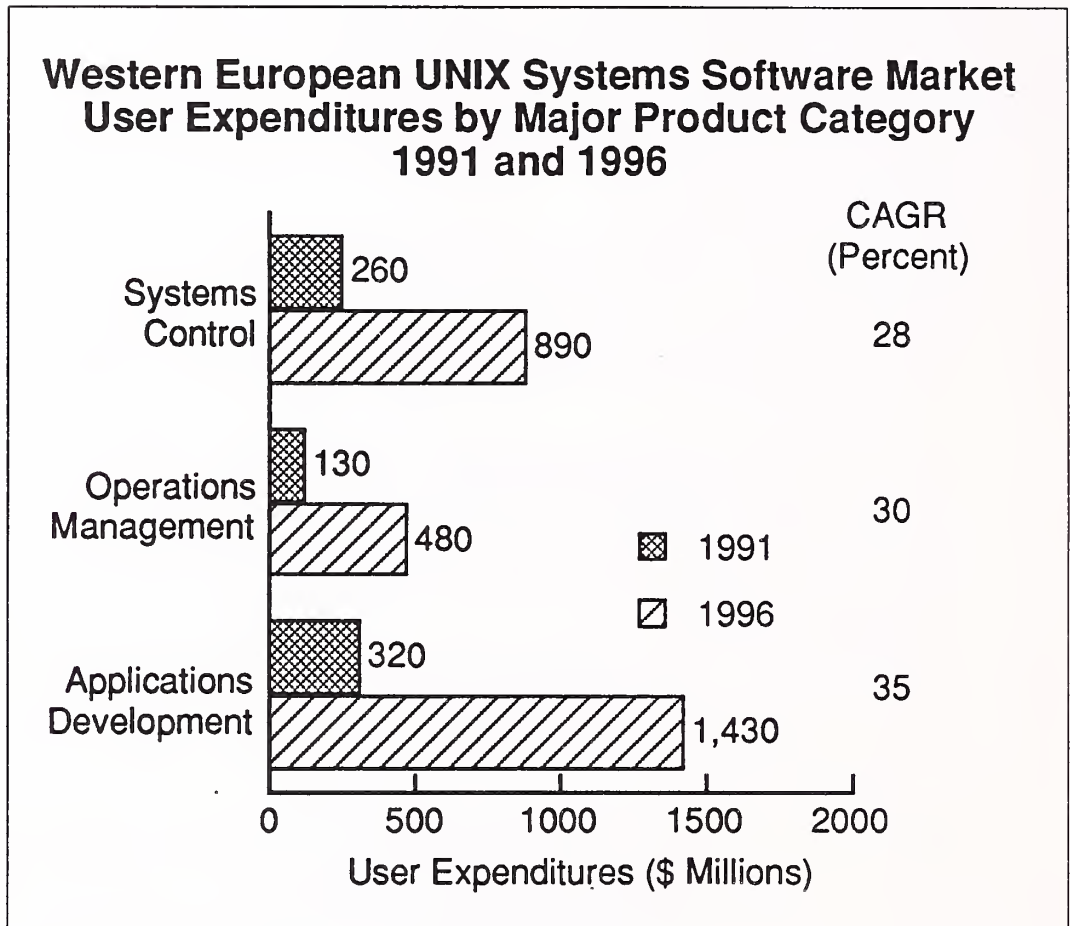
D

European UNIX Marketplace

As shown in Exhibit VI-8, the market for UNIX-related systems software in Western Europe is estimated at \$697 million in 1991, to grow to \$2.8 billion by 1996—about half the size of the U.S. market. Note that this forecast encompasses all three systems software product categories—systems control, operations management, and applications development tools.

The CAGR of 32% for the European UNIX market compares favorably to the CAGR of 25% for the U.S. UNIX systems software market through 1996.

EXHIBIT VI-8



Although the European market potential for UNIX is considerably smaller than that of the U.S., the rate of UNIX implementation is more rapid. Germany is the largest UNIX market in Europe, having had the benefit of a strong government mandate for open systems and heavy commitment from both Siemens and Nixdorf (now SNI) to UNIX standards.

Throughout Europe, as well as in Germany, the government sector has been, and continues to be, a strong stimulus to UNIX growth. Encouraged by the European Commission, governments are imposing mandatory requirements for UNIX and other open system standards to be met for all new computer system purchases. In general, only compatibility with installed software or national security considerations can be used by central government departments to avoid requirements such as compliance with POSIX and OSI standards. Local government bodies are not quite so constrained, but UNIX is growing in popularity as the means to get best value for money over the lifetime of a system.

Nonetheless, even by 1996, the UNIX segment of the systems software products market in Europe will still be dwarfed by products for proprietary operating systems. UNIX systems software products will account for between 10% and 15% of user expenditures on all systems software by 1996.

Japanese activity in the UNIX market is still relatively insignificant.

E

Impact of UNIX on Other Information Services Delivery Modes

As summarized in Exhibit VI-9, UNIX will impact not just systems software but other information services delivery modes, leading to significant vendor restructuring as software and services start to dominate user budgets and spending decisions.

EXHIBIT VI-9

Impact of UNIX on Other IS Delivery Modes

Delivery Mode	Impact of UNIX
Processing Services	<i>Short-term:</i> Minimal impact <i>Long-term:</i> Profit squeeze as customers bring services in-house to run on workstations.
Turnkey Systems Vendors/VARs	<i>Short-term:</i> Opportunities for increasing sales as UNIX hardware vendors exploit this channel. <i>Long-term:</i> Increasingly lower hardware margins will force turnkey systems vendors/VARs to expand systems integration and professional services role.
Applications Software Products	<i>Short-term:</i> Market advantages to companies with UNIX products; niche players make inroads. <i>Long-term:</i> Applications software standards, reduced development costs, more competition, lower prices and industry consolidation
Systems Integration	<i>Short-term:</i> Small specialized companies enter the void <i>Long-term:</i> Large systems integrators move to open systems work; increasing competition from systems vendors who want to maintain major account control
Professional Services	<i>Short-term:</i> Opportunities for consulting, applications development, education and training abound, creating growth for this delivery mode <i>Long-term:</i> More growth
Systems Operations	<i>Short-term:</i> Minimal impact <i>Long-term:</i> Minimal impact

1. Processing Services

As user organizations continue their downsizing efforts, it will become economically feasible to bring some services in-house that were previously done by outside services firms. Processing services vendors will need to continue to seek out ways to add value to their services that customers would not be able to provide for themselves, while remaining price-competitive with internal alternatives.

2. Turnkey Systems Vendors/VARs

In protecting their traditional customer sales and margins, traditional hardware vendors will, at least in the short term, rely heavily on distribution of their UNIX product lines through indirect channels—including their VAR networks—rather than through their direct sales forces. This will stimulate the growth of turnkey systems vendors and VARs and the software and services with which they add value.

In the longer term, however, standard hardware will further deteriorate margins for turnkey systems vendors and VARs, who are already suffering from margin erosion. Standard software will also diminish the added value that third parties can offer.

3. Applications Software Products

Revenue growth in last several years has been in a respectable 20%-25% range for publicly held applications software firms. A large portion of this revenue growth is due to continued acquisitions and industry consolidation, growth in international sales (Computer Associates' net income from foreign operations was 28% of the total for 1990; Microsoft's international sales were 55% of total fiscal 1990 revenues; and Oracle's international sales are 49% of total revenues), and increasing emphasis on professional services.

Applications software vendors' revenue growth is not necessarily due to growth in applications software products themselves. These vendors must therefore seek ways to leverage their development efforts and costs and expand the markets for their products.

The promise of consistent, well-defined interface standards and the existence of over 600 possible UNIX-based hardware platforms is encouraging even the most staid software companies to develop or convert products for UNIX. Standards will eventually allow applications software vendors to reduce development costs.

As UNIX compatibility issues become simplified by the specification of ABIs (application binary interfaces), the market for software packages will become more competitive. Differentiation will become as much an issue of service and support and marketing strength as technical product excellence.

4. Systems Integration

The demand for systems integration will parallel the demand for UNIX, both being the result of demand for more distributed applications systems. UNIX offers flexible, low-cost platforms. Systems integration promises to knit together large multivendor systems solutions, exploiting existing IS investments to the full.

5. Professional Services

Professional services vendors will range from those who offer specialist UNIX services like technical education and training or consulting, to those who have naturally started to consider UNIX-based solutions for their entire range of professional services: feasibility studies, architecture recommendations, custom software development, etc.

With UNIX, professional services vendors will become even more independent of their equipment vendors, leaving the client to make the choice of hardware and/or software supplier. This extra degree of freedom opens up wider markets to the service vendor and can contribute to improved margins or greater added value for services.

Customers requiring help in the transition to UNIX and open systems will create special demands on vendors who have already built up UNIX-based skills. This is likely to be a long-term demand, as the migration to UNIX-based systems will last out the decade, but the skills most in demand will relate to C programming techniques, the new software platform environments, and to application areas, rather than to the technical intricacies of the UNIX operating system itself.

Overall, UNIX enables these service vendors to minimize their concern with hardware and operating system technicalities and concentrate on the skills most valued by their customers—converting business requirements into working IS solutions through their in-depth knowledge and skill.

6. Systems Operations

A user's decision to go to open systems may lead to a decision to outsource the maintenance, support, operations or management of existing systems during the transition phase between old and new systems. Other than this minimal impact, INPUT does not believe UNIX will have a noticeable effect on systems operations. Systems operations is a mainframe operations business and UNIX will not play an active role in the mainframe arena.



Conclusions and Recommendations





Conclusions and Recommendations

A

Conclusions

Conclusions are summarized in Exhibit VII-1.

Many business issues and technology developments are coming together to make the market receptive to UNIX. Several of these issues and technology developments are the awareness that white-collar productivity must be boosted and that disparate systems and software products do not work effectively together, the increasing availability of low-cost workstations that threaten large systems shipment rates, and the slumping profits of large systems software vendors.

EXHIBIT VII-1

U.S. UNIX Market Conclusions

- Slow worker productivity gains
- Convergence of technology developments sets stage for UNIX adoption
- Technology push
- Users to follow

What needs to happen, however, for broad-scale UNIX implementation is better and more vendor preparation, more systems and applications software products availability, resolution of interoperability issues, more fully developed distribution channels and support services and, last but not least, more customer understanding about UNIX. Obviously, a great deal needs to take place.

Thus, although user expenditures for UNIX systems software products are expected to increase at the rate of 25% compounded annually over the next five years, UNIX will only have penetrated 13% of the systems software market by 1996.

In the meantime, UNIX complicates the overall IS industry. Every additional "standard" product has a tremendous multiplier effect. Thus a true open systems standard is an unrealistic expectation, and UNIX variations will coexist with proprietary variations. Due to the complexity caused by these variations, service and support will play an important role in vendor selection.

The short-term advantages of UNIX are the time and money saved in applications development efforts; this is where much of the current product is appearing. The long-term principal advantages of UNIX—interoperability, portability, scalability—will not be fully realized until after 1995. Users who are successful in implementing UNIX today understand this.

Competitive pressures between vendors stimulated the original demands for UNIX, and the UNIX marketplace is still in a technology push rather than a market pull situation. Systems vendors are beginning to make a fundamental shift from closed to open systems. Such a transition takes time and talent. With this movement by large vendors, broader full-function software products will be available by 1993. Large vendors will then have to learn to truly sell UNIX systems as well as their proprietary software technology. How to sell both and not confuse the client is a challenge they haven't yet adequately addressed.

B

Recommendations

Given these conclusions, Exhibits VII-2 and VII-3 summarize INPUT's recommendations for UNIX users and vendors.

EXHIBIT VII-2

U.S. UNIX User Recommendations

- Identify pockets of applications that make sense for UNIX
- Go slow on interoperability; no need to rush into UNIX
- Beware of what "open" means
- MIS must proactively learn about UNIX

EXHIBIT VII-3

U.S. UNIX Vendor Recommendations

- Lower the hype
- Have competitive workstation product offering
- Have concise and clearly defined UNIX strategies
- Emphasize advantages of applications development tools and provide integrated CASE
- Beef up system administration and performance monitoring product offerings
- Begin to migrate direct sales forces to UNIX
- Provide strong professional services and systems integration offerings that emphasize the advantages of UNIX
- Specialized UNIX vendors: Prepare for the long haul

Report Quality Evaluation

To our clients:

To ensure that the highest standards of report quality are maintained, INPUT would appreciate your assessment of this report. Please take a moment to provide your evaluation of the usefulness and quality of this study. When complete, simply fold, staple, and drop in the mail. Postage has been pre-paid by INPUT if mailed in the U.S.

Thank You.

1. Report title: ***U.S. UNIX Market, 1991-1996*** (UUIS3)
2. Please indicate your reason for reading this report:

<input type="checkbox"/> Required reading	<input type="checkbox"/> New product development	<input type="checkbox"/> Future purchase decision
<input type="checkbox"/> Area of high interest	<input type="checkbox"/> Business/market planning	<input type="checkbox"/> Systems planning
<input type="checkbox"/> Area of general interest	<input type="checkbox"/> Product planning	<input type="checkbox"/> Other _____
3. Please indicate extent report used and overall usefulness:

	Extent		Usefulness (1=Low, 5=High)				
	Read	Skimmed	1	2	3	4	5
Executive Overview.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Complete report.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part of report (____ %).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. How useful were:
Data presented.....☐.....☐.....☐.....☐.....☐
Analyses.....☐.....☐.....☐.....☐.....☐
Recommendations.....☐.....☐.....☐.....☐.....☐
5. How useful was the report in these areas:
Alert you to new opportunities or approaches.....☐.....☐.....☐.....☐.....☐
Cover new areas not covered elsewhere.....☐.....☐.....☐.....☐.....☐
Confirm existing ideas.....☐.....☐.....☐.....☐.....☐
Meet expectations.....☐.....☐.....☐.....☐.....☐
Other _____.....☐.....☐.....☐.....☐.....☐
6. Which topics in the report were the most useful? Why? _____

7. In what ways could the report have been improved? _____

8. Other comments or suggestions: _____

Name

Title

Department

Company

Address

City

State

ZIP

Telephone

Date completed

Thank you for your time and cooperation.

M&S 633/01 12/89

INPUT

FOLD HERE



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

First Class Permit No. 982 Mountain View, CA

POSTAGE WILL BE PAID BY ADDRESSEE

Attention: Marketing Department

INPUT

1280 Villa Street

Mountain View, CA 94041-9912



FOLD HERE

